ENGINEERING NEWS-RECORD

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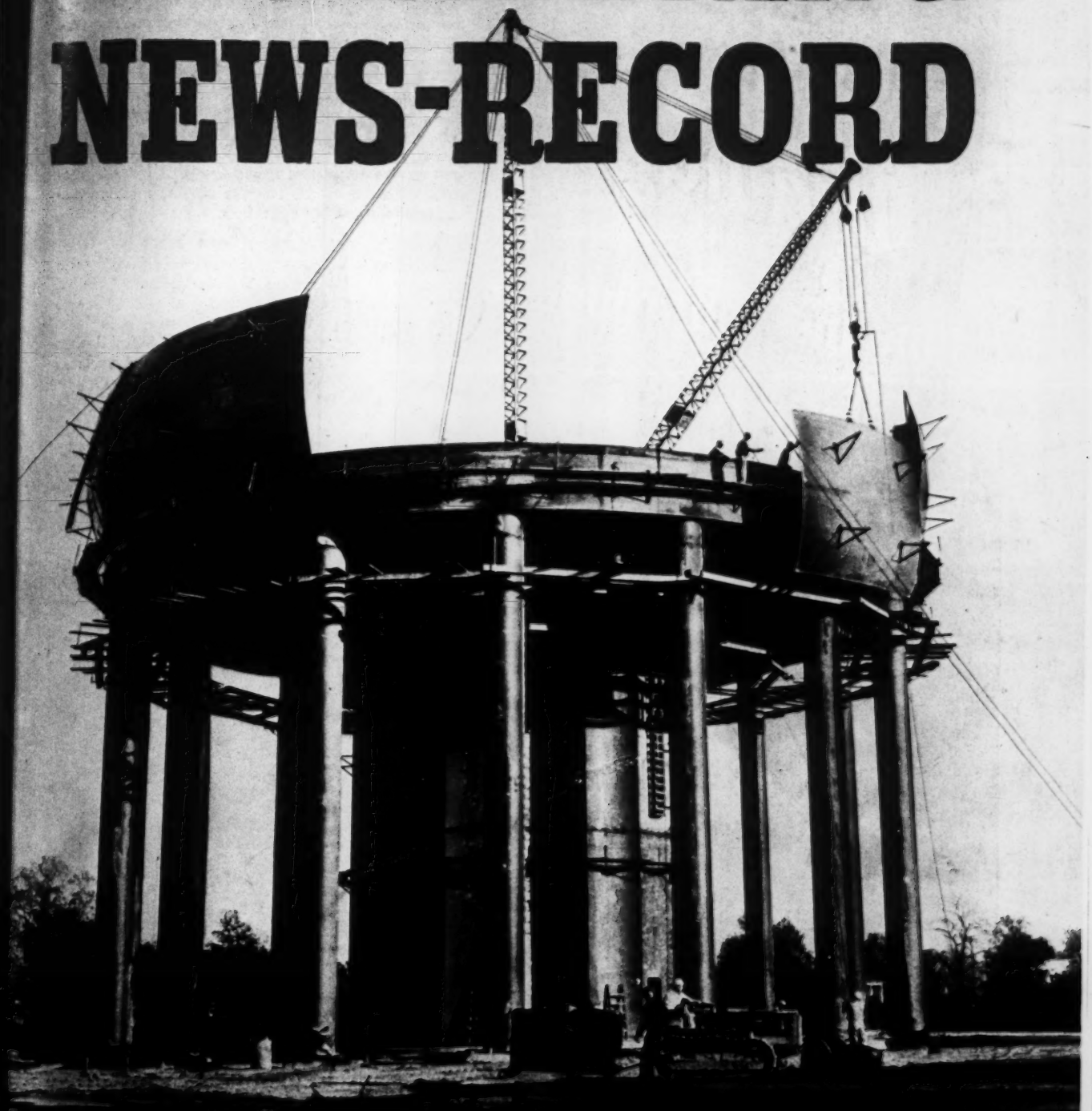

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Volume 136 • Number 18

MAY 2, 1946

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FEATURES IN THIS ISSUE

News of the Week..... 69

Editorials..... 78

Welded Girder Bridge is 1,500 Ft. Long.....D. B. ARMSTRONG 80

Converting Barracks Into Livable Homes.....C. C. ROTH 84

Airfield Paving by U. S. Army Engineers..... 87

Truck Size and Weight Limits Approved..... 88

Making Cement Finer May Decrease Durability..... 89

Our P. O. L. Pipelines to China..... 90

Equipment Developed for Mass Production of Houses..... 93

WATERWORKS SECTION

Unit Construction of a Filter Plant..... 97

Tapping a Wet Well Under Pressure..... 101

Lobster's Tail Inspired Flexible Pipe Joint.....M. N. BAKER 104

Increasing Flow Through a Gravity Tunnel.....D. M. RADCLIFFE 106

Cement Joints for Cast-Iron Water Lines.....K. F. HOEFLE 108

A Multiple-purpose Seal Coat for Waterworks.....P. WEIR 110

Water District Makes Its Own Zeolite..... 114

Fluted Central Column in Tank Design.....R. M. DOWE 116

DEPARTMENTS

New Construction..... 65

Construction Scoreboard..... 67

Comment and Discussion.....119

Material Prices.....122

New Aids.....128

Elections and Activities.....138

Men and Jobs.....144

Manufacturers Activities.....156

Manufacturers Publications.....164

Construction Reports.....209

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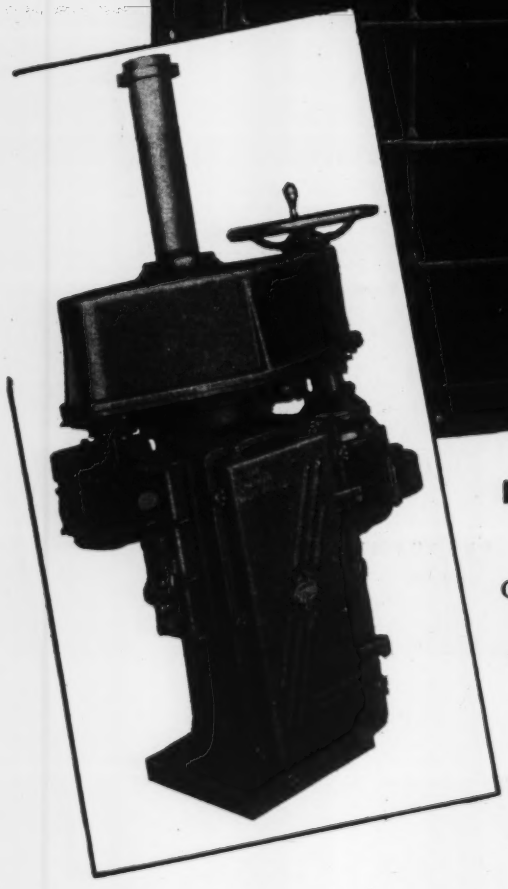
CHAPMAN
Standard Sluice Gates



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INDIAN ORCHARD, MASS.

News of the Week

ENGINEERING NEWS-RECORD • MAY 2, 1946 • VOLUME 136 • NUMBER 18

Services' building machines being returned for home use

Navy has already sent back 22 shiploads and has 73 shiploads en route—Army reports comparable program—New legislation will channel many items to veterans

Large quantities of construction equipment are being returned to the United States from Pacific bases by the Army and Navy, officials in Washington said April 29. The equipment includes tractors, crawler cranes, ditchers, air compressors, crushing plants, carrying scrapers, rock drills and many other items in critical supply.

However, once the equipment is turned over to the War Assets Administration for disposal, the selling process to be followed is extremely slow, since preference must be given to veterans and other special purchasing groups. Therefore, it may be some time before the contractor who is short of equipment will note the benefit of the return.

On Feb. 22 the Chief of Naval Operations issued orders to theater commanders to return all new equipment in critical supply, plus that in "excellent" operating condition needed at home. Since that date, 22 shiploads containing 24,871 measurement tons of construction machinery have been returned to the U. S., and 73 ships loaded with 55,600 measurement tons are now en route, according to Rear Admiral Carl H. Cotter, chief, material division, Office of the Assistant Secretary of the Navy. (One measurement ton is 40 cu. ft. and two measurement tons equal about one long ton.)

The Navy expects 40 shiploads of construction machinery to arrive in May, 40 in June, 20 to 25 in July, and 8 to 10 in August and September. Many of the ships will probably be loaded with a combination of construction equipment, critical building materials and civilian items in short supply, rather than construction tools alone. Some of the ships will be small craft, but the equipment they will return will add up to an impressive total. Most of the craft are unloading at California ports.

The Army also has underway an intensive program to return from the Pacific all surplus construction equipment now in critical supply in this country. Some 110 ships loaded with surplus Army items, including large amounts of construction equipment, are now en route to the U. S. from that theater, the War Department reports. Details of the transfer are not known.

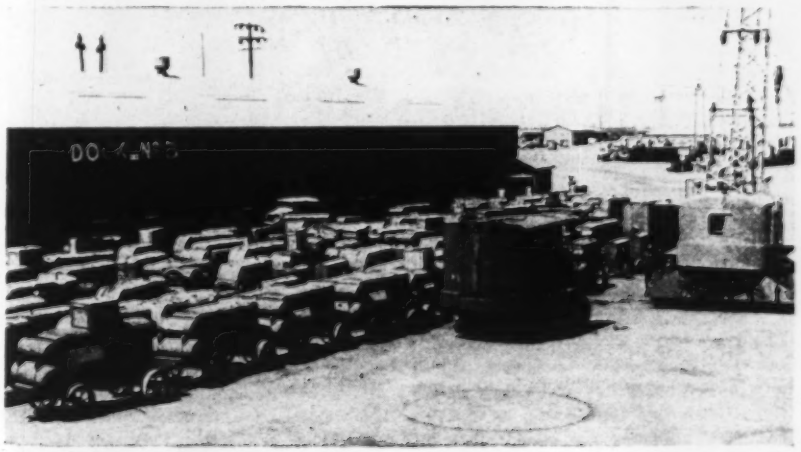
Disposal procedure is changed

A bill (H.R. 6157) recently passed by Congress will change the procedure to be followed by the War Assets Administration in disposing of construction equipment in critical supply. This law will require the WAA administrator to set aside or otherwise make available all surplus property, except real property, which he determines to be appropriate for exclusive disposal to veterans for their use.

In keeping with this plan, Lt. Gen. E. B. Gregory, WAA administrator, has issued orders that a long list of equipment be set aside for veterans. This list includes: all trucks of 2½-ton capacity, jeeps, tractor-type scrapers, air compressors, batching plants, crushing and screening plants, ditching machines, cranes, shovels and draglines. General Gregory has also ruled that most types of tractors should first be offered to veterans. The various makes, or their equal to be set aside, are: D4, R4, D7 and D8 Caterpillars, and TD6, TD9 and TD14 Internationals.

Such a ruling will permit about six groups to have a chance to buy construction equipment before dealers are permitted to purchase. These groups are: Veterans purchasing for their own use (as just explained); agencies of the federal government; veterans buying for resale; small business groups; state and local government; and non-profit organizations, such as education and public health institutions.

In anticipation of early signature of the bill by the President, General Gregory has already set aside much of the equipment earmarked to be sold to dealers at a $12,000,000 sale in St. Louis.



***Navy's Surplus Comes Home**—Lined up on the dock at Port Hueneme, Calif., is part of the first shipment of surplus Navy construction machinery shipped from Guam for sale to civilians through the War Assets Administration. Naval men said some of the machines are new, some in good and some in "fairly good" condition. The Navy expects to unload hundreds of thousands of tons of such surplus machines at U. S. seaports in next few months.*

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Construction—A $200,000,000 building expansion program for *St. Paul, Minn.*, is proposed by the St. Paul Association, of which $57,750,000 would be for industrial and commercial building. . . . Construction is now under way on a power house at *Chicago, Ill.* for the Sherwin-Williams Co., and on an office building and warehouse in the same city for John A. Roebling's Sons Co. . . . A $2,000,000 hotel at *Bal Harbor, Fla.*, is due for completion by fall. . . . Duke University has plans for an outpatient building for Duke Hospital at *Durham, N. C.*, to cost about $800,000. . . . About $4,300,000 will be spent shortly by *British Columbia* for social welfare buildings. . . . Construction is under way on a $6,000,000 federal office building at *Nashville, Tenn.* . . . Extension of the civic center and other public building at *Denver, Colo.*, to cost $9,500,000 is proposed. . . . At *Storm Lake, Iowa*, construction has started on a $750,000 addition to the meat packing plant of Kingan & Co.

Highways—*Michigan's* highway commission said its program will cost an estimated 30 to 50 percent more than it would have cost five years ago, on the basis of bids taken for the first eight projects. . . . At *Austin, Tex.*, the State Highway Commission announced appropriation of $668,000 for seven highway improvement projects in six counties. . . . At *Raleigh, N. C.*, the highway commission received 34 bids on roadwork estimated to cost $5,000,000. . . . In *Washington* state a $4,790,229 budget for maintenance of highways for the year to end March 31, 1947, has been approved. . . . A proposed 10-year, $2,600,000 *Ventura County, Calif.*, road and improvement program has been approved. . . . Highway 41 between *Marietta* and *Cartersville, Ga.*, will be relocated on account of Allatoona Dam at a cost of $2,000,000.

Bond Issues—To improve power and water works, voters of *Tonkawa, Okla.*, have approved a $221,000 bond issue. . . . *Allegheny County, Pa.*, on May 21 will seek approval for $33,000,000 for highways, bridges and airports. . . . *Miami, Fla.*, approved $13,246,000 for a sewage disposal system and 700 miles of sidewalks. . . . *Daytona Beach, Fla.*, has O.K.'d issuance of $2,750,000 of revenue certificates for a sanitary sewage treatment plant, sewers and water system improvements.

Sewerage and Waterworks—At *Columbus, Ohio*, a $2,000,000 extension of the sewerage system is planned. . . . A survey is to be made by Jones & Henry, of Toledo, for *Youngstown, Ohio*, in connection with that city's $2,000,000 sewage treatment facilities improvements. . . . *Wilkes-Barre, Pa.*, is preparing plans for sanitary sewerage system additions estimated to cost $2,898,800. . . . The *Indiana* Stream Pollution Board has approved preliminary plans for new sewage treatment plants at *South Bend* and *Middlebury*, and final plans for plants at *Tell City, New Carlisle*, and *Noblesville*.

Miscellany—A low bid of $1,415,102 has been received on the *Bayou Sorrell, La.*, project of navigation locks in the East Atchafalaya basin protection levee. . . . An Army Bailey bridge will replace a 157-ft. bridge across Rock River, *Rock Island, Ill.*, which collapsed March 18. . . . The estimated cost of a proposed causeway to connect the mainland of Nova Scotia with Cape Breton Island, at Canso Strait, is about $8,000,000, and about $4,000,000 for a lock. The cost of a steel bridge has been estimated at about $20,000,000. . . . Tentative contracts have been awarded for the proposed $65,000,000 natural gas pipeline from *Texas* fields to *Southern California*. . . . There are over 400 applicants for the May civil engineer registration exams at *San Francisco, Calif.*

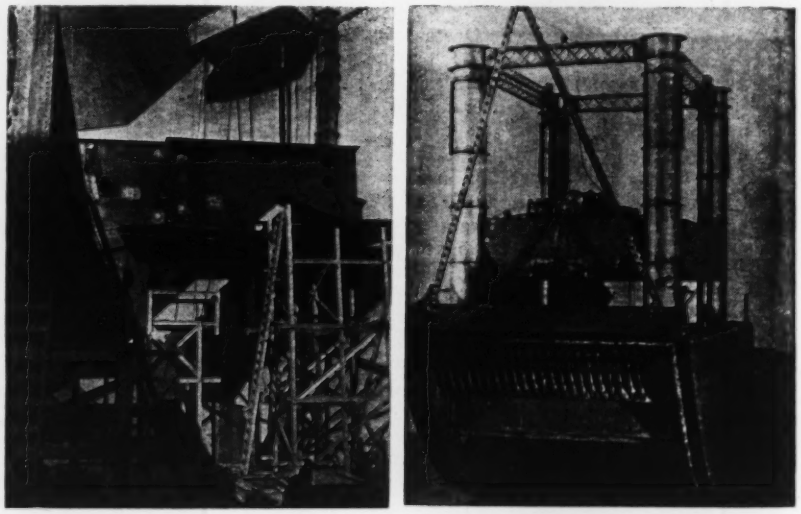
ASCE appoints committees on ports and air transport

Appointment of a committee on construction and operation of ports and harbors and necessary structures has been announced by the American Society of Civil Engineers.

Functioning under the society's waterways division, of which Col. C. L. Hall, Corps of Engineers, New York City, is chairman, the new committee is to "study and report on problems affecting the planning, design, maintenance and operation of ports and harbors, including coordination of port and harbor development with the needs of the locality and those of transportation interests; the possibility of future expansions to meet future needs; types of docks, breakwaters, jetties, handling equipment, and other facilities."

The society has also appointed the first executive committee of its recently-organized Air Transport Division of Civil Engineers.

The division, which recently was added to 12 existing technical divisions of the society, has as its objective "the advancement of scientific knowledge and the promotion of sound engineering thought and practice in the administration, economics, planning, design, construction, operation and maintenance of all facilities in the civil engineering field necessary to the efficient operation of air transportation."



***Caisson for Coulee**—Bureau of Reclamation workers erect members for a 1,600-ton floating steel caisson to be used to repair eroded concrete at the base of Grand Coulee Dam. One of the side plates is shown being assembled at the left, being the rear part of the side plates as shown in the 1:20 model at the right. Erection is proceeding in a specially-built drydock below the downstream face of the dam (ENR July 19, 1945, vol. p. 72) from which the caisson will be floated. Air-lock entrances are in the four towers shown on the model.*

Sanitary engineers will meet in Rio to inaugurate Pan-American conferences

Formation of permanent organization may result from June meeting aimed to promote professional and commercial relationships

First of a series of meetings to establish closer relations among sanitary engineers in all of the Americas has been scheduled for Rio de Janeiro, Brazil, during the week of June 10. Sponsorship for the meeting lies with the Pan-American Sanitary Bureau, working in cooperation with the Institute of Inter-American Affairs, the latter now a part of the State Department.

An objective of the meeting, which will be supplemented with a second conference to be held in Caracas, Venezuela, late in September, is to lay the foundation for a permanent Pan-American organization of sanitary engineers. Participants will include representatives from Argentina, Bolivia, Brazil, Chile, Paraguay, Peru, Uruguay and the United States. The Ministry of Health and Education of Brazil will act as host to this conference, to which all sanitary engineers are invited.

At Caracas, which is closer geographically to northern South America and Central American countries, the meeting in September will provide an opportunity for wider participation by all countries.

Formation of a permanent organization is to be coupled with an exchange of scientific ideas, creation of better relations and an acceleration of sanitation developments to promote economic measures in the Americas. Standards for sanitation in regard to international travel will also be discussed.

U. S. manufacturers interested

More than mildly interested in the success of the conferences are members of the Water and Sewage Works Manufacturers' Association, Inc., who are soliciting funds from its membership. A goal of $10,000 is sought—$5,000 for each conference—to defray some of the expenses of bringing American consulting engineers to the meetings and to print the proceedings.

The manufacturers were invited by Abel Wolman, president of the sanitary engineering committee of the Pan-American Sanitary Bureau, to make this contribution. Mr. Wolman pointed out that the sponsoring groups were prepared to spend about $60,000 on the meetings and that another $10,000 was needed.

Manufacturers are hopeful that the meetings will be helpful in developing a more sympathetic acceptance of United States standards and equipment.

Further conference information and hotel reservations in Rio may be secured by writing to Edmund G. Wagner, Institute of Inter-American Affairs, Avenida Rio Branco 251, Caixa Postal 1530, Rio de Janeiro, Brazil.

Further price rises on construction machinery

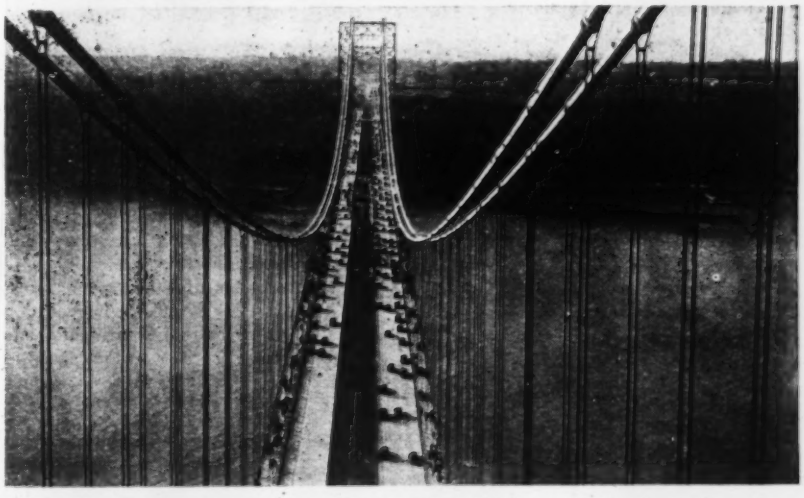
Prices of construction machinery rose approximately 1.5 percent during the first quarter of 1946, continuing the advance begun in October, 1945, after four years of almost complete stability. These increases brought average prices in March, 1946, to 114.9 percent of the August, 1939, level, according to the Bureau of Labor Statistics, U. S. Department of labor.

A number of manufacturers who had not previously taken advantage of the 5 percent interim price increase allowed by OPA advanced their prices during the first quarter of 1946. The Bureau's composite index of prices of construction machinery rose in each of the three months, the largest advance occurring in January as a result of increases of 2.5 percent in prices of power cranes and shovels, and of approximately 1 percent in prices of tractor-mounted equipment and specialized construction machinery. Further increases of about 4 percent in prices of tractor-mounted equipment (particularly dozers) together with lesser advances in prices of cranes and shovels, and of construction material mixers, pavers, and spreaders, caused the general average to advance 0.5 percent by March.

Prices of portable air compressors and of drilling and boring machinery remained unchanged, while prices of track type tractors and scrapers rose less than 0.5 percent during the quarter. Several manufacturers of power shovels and tractors reported price advances retroactive to October, 1945. These revisions caused prices for the year to average 11.2 per above their prewar levels.

CPA issues CC ratings on machinery

The CC ratings issued by the Civilian Production Administration for construction machinery cannot be extended beyond the dealers and sales organizations representing producers, the CPA announced April 22. However, producers selling direct to consumers must continue to accept such ratings, to prevent any disruption of producers' schedules.



***More Roadways for George Washington Bridge**—In the first of a series of projects to improve highway connections between New York City and its tributary areas, the Port of New York Authority will pave the center section of the George Washington Bridge, to give the Hudson River crossing an 8-lane roadway. Although original bridge plans called for this road width (plus four electric-railway tracks on a proposed lower level) the two center lanes were left unpaved when the structure was opened formally in October, 1931. Bridge deck is 4,760 ft. long between cable anchors. Other immediate projects will improve access to bridge, and to Holland and Lincoln tunnels.*

Name Colorado road chief after year's litigation

Mark U. Watrous, Pueblo contractor and road builder, took over April 16 as Colorado state highway engineer, relieving Arthur F. Hewitt with whom he had been in litigation over the job for more than a year.

Hewitt was appointed acting state highway engineer in January, 1945, after the death of Charles D. Vail. Shortly afterwards, the state civil service commission conducted a merit examination to select a permanent highway engineer and Watrous made the highest grade.

Hewitt then filed suit against the civil service commission seeking to prevent Watrous' appointment and charging that some of the test questions were unfair. The Denver district court dismissed Hewitt's original suit, and he then appealed to the supreme court, which ruled against him.

Governor Vivian said in a recent statement that he wants Mr. Hewitt to be assistant highway engineer, but Mr. Watrous countered with the suggestion that he should be structural designer—his permanent position under civil service.

Other highway appointments

The South Carolina Highway Commission on April 18 elected a new chairman and vice chairman, installed five new commissioners and approved a $6,000,000 secondary road building program.

J. L. Caudle of McCormick and W. G. DesChamps of Bishopville were elected chairman and vice chairman, respectively.

J. D. Lewis, chief engineer of the Mississippi State Highway Department for the Southern District, at Hattiesburg, who has resigned to enter private business, will be succeeded by J. W. Kornrumpf, who has been serving as office engineer there. Mr. Lewis has been with the Highway Department for more than 20 years. Mr. Kornrumpf, with the department for 14 years, is a graduate engineer of Mississippi State College. He recently returned from service.

The new secretary of the Pennsylvania Department of Highways, Ray F. Smock, (*ENR* March 28, vol. p. 447) has announced the appointment of Thomas C. Frame as chief engineer of the department, succeeding John L. Herber.

Mr. Frame was chief engineer from 1939 to 1943, resigning after having served 28 years in the department.

Also announced was the appointment of Charles H. Buckius as assistant chief engineer. He joined the department as a chainman in 1907 and became district engineer in 1920.

Mr. Buckius served as assistant secretary of highways and later was chief engineer of the department, resigning in 1944 to enter private practice.

Mass. public works director removed

Members of the Massachusetts Governor's Council April 24 approved Governor Maurice Tobin's order for removal of Herman A. MacDonald, who had been commissioner of public works since 1940.

The governor immediately announced the appointment of Rudolph F. King to replace Mr. MacDonald. Mr. King, former Registrar of Motor Vehicles, was a shoe manufacturer before entering the state legislature some years ago.

Governor Tobin announced late in March (*ENR* March 28, vol. p. 447) that he would seek removal of Mr. MacDonald on the ground of inefficiency and for the "good of the service." In formal charges brought at a hearing April 9 to 12, the Governor charged inefficient planning for the construction of the Logan Airport in East Boston; that the commissioner had furnished "inaccurate, misleading and incomplete" information on work being performed by his department; that "favored contractors" received confidential information on department plans; that the state civil service laws were disregarded to the detriment of department morale, and that handling of the federal aid highway program was inefficient.

At the hearing, Mr. MacDonald refuted the charge of inefficiency on handling the highway program with the statement that $17,000,000 in planned work was now ready for advertising. His counsel produced a report from a legislative subcommittee on aviation which noted "remarkable" progress in construction work at the Logan Airport; and elicited testimony from R. W. Coburn, highway department chief engineer, who said that depletion of the department's staff by about one-third, together with changes in federal specifications, which necessitated, in some instances, the re-drawing of plans already prepared, were principal cause of delays in furthering the highway program.

As to the charges of "favoritism" to contractors, Mr. MacDonald's counsel said that for more than 20 years the department had made it a practice to make advance construction plans available to prospective bidders.

Mr. MacDonald, who was president of the American Association of State Highway Officials during the year 1944-45, had been secretary to three Massachusetts governors, was a member of the state legislature (1911) and was twice mayor of the City of Beverly.

Virginia governor signs pollution control bill

A bill that authorizes appointment of a pollution control board with certain powers over control of state stream pollution problems was signed recently by Governor Tuck of Virginia.

Brought before the state's legislature last January (*ENR* Jan. 10, vol. p. 18) the bill provides that the board supervise work of "competent" men employed by other state departments, dealing with pollution problems in the state's rivers and streams. The group, in cooperation with the state Health Department, is to be charged with passing on the merits of plans for new sewage disposal plants, among other duties.

Pa. issues more cleanup orders

Notices have been sent to 40 more municipalities in Pennsylvania—bringing the total so warned to 502—in the Commonwealth's "clean up the streams" campaign being waged by the Pennsylvania Sanitary Water Board.

Further steps to control stream pollution include action by the state board of health to contract with the Mellon Institute of Industrial Research at Pittsburgh for studies on the elimination of acid mine drainage.

Texas public works plans call for $210,376,782

Texas public works projects scheduled to cost $210,376,782 are in planning stages, W. H. Sindt, Fort Worth division engineer for the Federal Works Agency's bureau of community facilities, has announced.

Not including highway construction programs, 563 projects are planned by counties, towns and school districts, with federal participation asked on 236.

Even with this mass of planning, however, Sindt professes alarm at the large numbers of governmental subdivisions that are doing no planning—he found 80 counties, 79 towns and 222 school districts had no planning programs.

Highway construction being considered under the national state aid highway program totals $55,130,000, Sindt said. Projects for which plans have been completed will cost $30,950,000. Those for which plans are in the design stage entail a predicted cost of $24,180,000.

Many communities and subdivisions are planning their projects without federal assistance. Of the 327 such projects, 218 are in the design stage and are expected to cost $74,047,000. The other 109 have completed plans calling for expenditures of $16,952,000.

Plan St. Louis water supply expansion

Early completion of detail plans and specifications for a 5 to 8-year, $19,000,000 expansion of the St. Louis, Mo., water purification system was predicted recently by Harry C. Brockhoff, director of public utilities, and Thomas J. Skinker, city water commissioner.

The program also includes improvement of distribution facilities to increase the daily output by about 20,000,000 gallons.

Mr. Brockhoff said that preliminary plans are now being studied by the engineering firm of Horner and Shifrin—engaged by the St. Louis Citizens' Supervisory Committee. The committee will receive a final report from the consulting engineers on or about the 15th of May, and will then be in a position to make recommendations to the Board of Public Service as to the first projects on which bids will be asked.

Commissioner Skinker said that distribution facilities now operated through the Compton Hill Reservoir district have a pressure of only 50 lb. per sq. in. as compared with an average pressure of 75 lb. maintained by the service provided through the Stacy Park Reservoir, to which water is pumped from the new Howard Bend plant on the Missouri River. He pointed out the need of a new high pressure tunnel to replace the present gravity conduit between Chain of Rocks plant and Bissell's Point to increase pressure to Compton Hill and the entire eastern portion of the city.

The officials said the enterprise will impose no financial strain upon the city's general revenue because about two-thirds of the money required will be provided by accumulated funds of the Water Division, while the balance will be obtained through issuance of revenue bonds to be serviced and retired through future water rates receipts.

Jacksonville zones for pressure

In an effort to avert a water shortage and insure a uniform pressure throughout the city, the water department of Jacksonville, Fla., announced recently that the city has been divided into zones. The water department will assign definite periods each day for lawn-sprinkling within each zone, in order to prevent large scale drains on the system. Two hour periods, in general, are set aside for sprinkling lawns in each zone.

Dam will aid Pittsburgh

A new dam on the east branch of the Clarion River, for which Congress recently granted an appropriation of $500,000, is expected to reduce the danger of pollution in the Pittsburgh, Pa., water supply system, in addition to its primary purpose of providing flood protection by creating a storage reservoir.

The dam and related channel works are primarily for the protection of the towns of Johnsonburg, St. Marys, Ridgway and Brockway, but it is expected to decrease the polluted condition of the Clarion River—a tributary of the Allegheny River, from which Pittsburgh takes most of its water supply. Army engineers said that the project will provide for regulation of stream flow, enabling dilution of waste in the river during low periods.

Coast Line R. R. pushing major reconstruction job

The Atlantic Coast Line Railroad recently disclosed that it is rushing to completion what it said is the largest roadbed and track rehabilitation program in the country.

Planned and prosecuted under the direction of C. McD. Davis, president of the line, the job was actually begun in 1943, but little was completed that year, as extensive preliminary work was necessary.

The program got fully under way in 1945, when 326 track-miles of new 131-lb. rail were laid in mainline tracks, 213 track-miles of 100-lb. relay rail were laid on secondary main lines and 43 miles of 85-lb. relay rails were laid on important branch lines. Other extensive work was also carried out in 1945, including the replacement of 1,822,509 crossties.

When the program is completed—it is scheduled to extend into 1947, and possibly longer—officials said the line's double-track main road between Richmond, Va., and Jacksonville, Fla., will be a "speedway to the South."

N. P. relocating tracks

The Northern Pacific Railway has awarded contracts for a $2,500,000 main line relocation in North Dakota.

The project, between New Salem and Kurtz, N. D., will reduce mileage 9.3 miles and grade from 1% to 0.45%. About 4,000,000 cu. yd. of material will be moved. Four large bridges and a grade separation at Kurtz will be required. The old abandoned roadbed will be donated to Morton County for use as a highway.

Foley Brothers, Inc., St. Paul, Minn., in partnership with Marsch-Peterson Co., Omaha, Neb., have the grading for the east half of the job and A. Guthrie and Co., St. Paul, have the west half.

Site is chosen for Genesee River Dam

News of other flood control projects in other sections of United States

Selection of a site for the $10,000,000 Genesee River (N.Y.) flood control dam has been made by consulting engineers and Army Engineers, at a point along the High Banks about 1½ miles southwest of Mt. Morris, N. Y., according to Col. Herbert D. Vogel, district engineer.

Advertising for bids on various phases of the construction will be done within the next few weeks, Colonel Vogel said. It was indicated that a lump appropriation for the job would make possible its completion within two years.

The dam will be of the concrete gravity type, rising 244 ft. above the river bed at its highest point, and its bank-to-bank span will be 1,050 ft. The length across the river will be divided into an east side abutment of 245 ft., a west side abutment of 255 ft. and the center spillway section 550 ft. long.

Earth dam at Wood Falls, Vt.

The Public Electric Light Co., St. Albans, Vt., has been authorized to build a dam at Wood Falls on the Lamoille River in the town of Milton, Vt. The structure will be an earth dam with a spillway, impounding about 70 million cu. ft. of water. The elevation of the dam crest will be 147 ft., and the hydroelectric development would supply about 20,000,000 kw. annually.

Approve two Northwest dams

The Portland, Ore., district and Pacific division U. S. Army Engineers have forwarded to the Chief of Engineers recommendations for construction of an earthfill dam on the Boise River in Idaho and a concrete dam on Willow Creek near Heppner, Ore.

The Boise River dam, which would be primarily for flood control, would store approximately 306,000 ac. ft. of water. It would be 250 ft. high and 1,700 ft. long and would be located near Lucky Peak, about nine miles from Boise.

The Willow Creek dam, for flood control and irrigation, would be 1,300 ft. long, 100 ft. high and have a storage capacity of 5,000 acre ft.

Exploratory drilling to determine suitable foundation sites for the 10 navigation dams authorized by Congress to complete the Snake River (Idaho) waterway to Lewiston, Ida., has been started by the Army Engineers.

The project covers 11 locations for the dams, starting at Indian, 124 miles upstream from the mouth of the Snake, which flows into the Columbia, and finishing at a site 28 miles from the mouth of the stream.

Los Angeles gets sewage plant bids

Bids were opened recently by the Los Angeles Board of Public Works, on excavating phases of the $21,000,000 sewage disposal plant to be built at Hyperion, to modernize the sewage disposal systems of the city and surrounding suburbs. Lowest of seven bids was $3,494,088.

The excavating phases of the project, with an estimated 14,100,000 cu. yd. of sand to be moved, is scheduled for completion in about 30 months, with construction phases following excavating, step by step, so the entire plant is expected to be completed shortly after final excavating is done.

Included in the initial contract will be removal of one large and several small buildings now on the site of the sewage plant.

Bids were opened April 11 for chlorination equipment, to be installed immediately. Later, this equipment is to be salvaged and installed in the permanent sewage-treatment facilities.

Announcement of the amounts of the chlorination equipment bids will not be made known until after they have been evaluated.

Recently advertised was a contract for erection of housing and installation of the chlorination equipment. Invitations for such bids were issued April 11.

This work is being done as part of a program to clean up coastal waters.

Santa Barbara begins studies

Contracts have been signed by Santa Barbara, Calif., and the engineering firm of Koebig and Koebig, Los Angeles, for preparation of plans for a $750,000 sewage disposal plant and a $180,000 municipal incinerator. A federal advance of $5,400 has been made for plans for the incinerator, and application has been made for $18,750 for plans for the sewage plant.

The action of the city council accompanied local publication of a report by Dr. C. T. Roome, city health officer, covering a study of the city's sewage problem, that existing facilities are taxed to capacity. State authorities have announced that all outstanding permits for dumping raw sewage into the ocean will be revoked Jan. 1, 1947.

Santa Barbara's present sewage disposal system was completed in 1925 and was designed for a population limit of 50,000 to 60,000. This capacity soon will be exceeded.

San Diego seeks merger of water units

Application has been made by the San Diego, Calif., County Water Authority for annexation of its 150 square miles of territory, which includes nine municipalities and water districts with a population of 370,000, to the Metropolitan Water District of Southern California.

The step fulfills an agreement with the Navy Dept., which is constructing a $15,000,000 aqueduct to connect the Metropolitan's line at the west portal of the San Jacinto tunnel with San Vincente Reservoir northeast of San Diego. (*ENR* Oct. 25 '45, vol. p. 547).

In response to the San Diego request, Chairman W. P. Whitsett of the Board of Directors of the Metropolitan District has sent a letter setting forth the terms of the proposal. They include payment, over a 30-year period, of approximately $13,000,000 in back taxes, to be paid at the rate of about $433,000 a year; merging of the San Diego district's water rights, by which it is allocated 155 sec.-ft. from the Colorado river, with the Metropolitan's 1,500 sec.-ft.; and payment of annual taxes on property within the San Diego district.

Other conditions include assumption by the Metropolitan District of half of the cost of the $15,000,000 water line now being built by the Navy, and taking of title to about half of the 70-mile line. Under its present contract with the Navy, San Diego is pledged to rent the Navy-built line at a cost of $500,000 annually, until the Navy's costs have been amortized, or until such time as San Diego wishes to purchase the Navy's remaining investment in it. The Metropolitan District would assume half of these annual charges under the proposed merger.

In addition to the city of San Diego, the San Diego County Water Authority's district includes the cities of Oceanside, Coronado, National City and Chula Vista; the La Mesa, Lemon Grove, Ramona, Spring Valley and Lakeside irrigation districts; and Fallbrook Public Utility district, having a combined assessed valuation of $270,000,000.

The Metropolitan Water District includes the city of Los Angeles and 13 other cities and areas in Los Angeles and Orange counties. Others are Long Beach, Pasadena, San Marino, Glendale, Burbank, Beverly Hills, Santa Monica, Torrance, Compton, Santa Ana, Anaheim, Fullerton and the Coastal Municipal Water District, which includes Laguna Beach and Costa Mesa.

Burbank to construct distribution reservoir

New mains for New Orleans—Other water supply activities

Advertisements for bids will be published in about 30 days, by Burbank, Calif., for construction of a 25 m.g., reinforced-concrete water distribution reservoir, and a 4,000-ft., 30-in. diam., delivery main to the new reservoir. These new facilities are estimated to cost $650,000 and $90,000 respectively.

In about 60 days, it was estimated, bids will be sought for construction of a third steam electric power plant of 20,000 kw. capacity, estimated to cost $2,000,000. The new plant will be the third unit of the municipally-owned plant, first and second units of which have 10,000 kw. capacity each. A fourth unit, also of 20,000 kw. is projected for construction within the next five years.

The water and electric projects now about ready to go ahead are part of a $5,000,000 program scheduled for construction in the next five years.

New Orleans asks bids on mains

Catching up on badly-needed, deferred improvements, the New Orleans Sewerage and Water Board will advertise in less than sixty days for 41,440 lin. ft. of water main pipe. Bids will be asked on both cast-iron and steel pipe.

Because of the thinner wall in the steel pipe, the inside diameters of the steel are slightly greater than the same dimensions for the cast-iron. Classified in accordance with the inside diameters of the steel pipe, the required lengths for various sizes are as follows: 50-in., 14,300 ft.; 43.7-in., 9,400 ft.; 37.7-in., 11,640 ft.; 31-in., 6,100 ft.

New pump for Rochester

Purchase of a powerful pump to increase the delivery of water in conduits leading from Hemlock Lake by 11,000,000 gpd. has been approved by the Rochester, N. Y. city council.

The pump will be set up at a point five miles north of the lake, where a tunnel delivers water to the three conduits serving the Rush reservoir.

Pennsylvania Water Co. sold

The Pennsylvania Public Utility Commission has approved the purchase of the Pennsylvania Water Co., by the Wilkinsburg-Penn Joint Water Authority of Wilkinsburg, Pa. The purchase price is approximately $7,093,430. Alex. Brown & Sons, Baltimore, Md., bankers, are selling $7,300,000 of serially-maturing 40-year bonds to cover the purchase cost and to provide working capital.

Senate bill making NHA permanent, establishing policy, forwarded to House

Wagner-Ellender-Taft bill approved by senators requires annual housing report—Other action on housing problem solution listed

The long-range Wagner-Ellender-Taft housing bill (S. 1592) last week had been passed by the Senate and sent to the House.

As approved, the bill makes the National Housing Agency a permanent organization, establishes a national housing policy, provides assistance for private groups in moderate-cost housing construction, and supplies aid for cities on low-cost housing and the clearance of slums.

The NHA administrator is required by the bill to make a yearly report on the country's housing needs and how these may best be met. It is anticipated that 12,600,000 new homes will be required during the next ten years.

The Senate version requires that the prevailing wage be paid on home construction financed with FHA-insured mortgages, the FHA being permitted to insure 95 percent of the cost of constructing a private homes. For housing construction by insurance companies and other large investors, FHA is given the authority to insure—on a 50-yr. basis—an annual interest return of 3¼ to 4 percent on investment in mass housing.

Federal assistance for public low-rent housing will start at $22,000,000 for the first year and at the end of four years would total $88,000,000 annually.

To aid in acquiring and clearing slum areas for housing projects, federal loans up to $500,000,000 would be authorized. Federal contributions in this work could also be made at the rate of $4,000,000 for the first year, increasing up to $20,000,000 after five years. A maximum of $35,000,000 annually for rural housing is also provided.

Wyatt changes priority aid

Another recent major development pertaining to housing was the announcement by Administrator Wyatt that priority assistance for veterans housing construction will be amended to provide maximum aid for homes costing about $6,000, dependent upon the locality.

Wyatt also issued a general order which he described as the first step toward channeling building materials into moderate and low cost housing. The order apportions certain definite percentages of new housing construction into rental units and low cost homes, making allowances for geographical differences in construction costs.

It established a housing "target" for each state or district office of the FHA and authorized each FHA director to apportion local "targets" for each city or area he may designate for the second quarter of 1946. The local target will provide that at least 25 percent of the dwelling units authorized shall be rental units; at least 50 percent of the dwelling units to be sold must be subject to a maximum sales price.

Mr. Wyatt also announced that building materials used by the National Housing Agency for conversion of surplus war housing and barracks to temporary housing for veterans will be kept to the barest minimum and will be drawn from government surplus stocks, rather than purchased in the open market.

Other action reported

As federal, state and municipal officials took further action to implement the housing program, these other moves were reported:

A nine-point emergency housing program for the state of Connecticut was announced last week by Governor Raymond E. Baldwin, who pressed for immediate adoption of the plan.

The program seeks: Organization of local committees in every community where the housing problem requires attention; complete cooperation with the appropriate agencies of the federal government; deferment of non-essential construction; full utilization of existing vacancies in federal war housing projects, and the conversion and use of existing dwellings; and temporary relaxation of local building codes, providing public health and safety is assured.

In Oregon, a $25,000,000 program, described as the largest private housing development undertaken in the Pacific Northwest, was scheduled for Astoria.

The project is backed by members of the Associated Property Owners of Portland, Ore., and construction will be by the A. B. Knowles Construction Co. of Portland. The program calls for construction of 1,500 individual dwellings to sell from $6,000 to $10,000; 1,500 additional dwellings, including 50 duplexes and an undetermined number of four- and six-unit apartment houses.

The Equitable Life Assurance Society announced plans for construction of a large scale housing development in the Bronx, New York City, to furnish moderate priced housing for about 1,500 families. The building will be elevator apartments, on an 8½-acre tract.

The Georgia Housing Co. of Macon, Ga., announced plans to build 500 to 1,000 prefabricated houses to sell for $6,000 each at Macon.

In New York City, Mayor William O'Dwyer began to implement an emergency housing program to provide an estimated 10,000 apartments through the rehabilitation of boarded up buildings, some of which have been tenantless for at least 15 years. The Mayor's action followed the recent passage of a state law permitting the city to grant tax concessions to owners of unoccupied multiple dwellings who undertake to renovate them and provide livable quarters at reasonable rents set by the city. City building inspectors in a single week disclosed some 266 unoccupied buildings that would provide 1,912 apartments if converted.

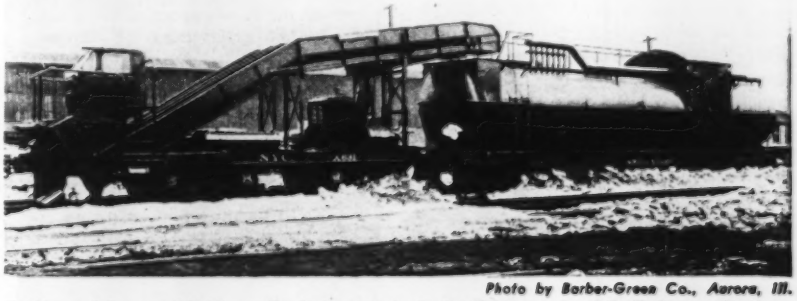


Photo by Barber-Green Co., Aurora, Ill.

Railroad Snow Melter—*To keep tracks in its Chicago and Buffalo yards clear during heavy snowfalls, the New York Central System recently acquired two machines like the one shown above, to scoop up snow and melt it into easily-disposable water. Mounted on heavy flatcars, the machines are built as two units. Pushed by a freight engine, the loader unit operates at 30 cu. yd. per min., throws snow onto two belt conveyors which drop the snow into the melting unit's 16,000-gal. melting tank. Steam for melting is supplied by pusher locomotive.*

More industrial buildings announced

Despite the application of the recent Civilian Production Administration order limiting non-housing construction (*ENR* March 28, vol. p. 441), manufacturers last week continued to announce plans for large-scale building construction, among them the following:

A $7,000,000 pulp and paper factory, to be built near Pensacola, Fla., by the Alabama Pulp & Paper Co. J. H. Allen, president, said that the new mill will employ about 2,500 people. He said that company engineers have completed all plans for the structure, and have also made plans for construction of 960 homes to house plant workers.

Another major paper plant for the Southern states was planned at Childersburg, Ala., by the Coosa River Newsprint Co., which said it would build a $10,000,000 factory there. Polk, Powell & Hendon, of Birmingham, are architects, and J. E. Sirrine & Co., of Greenville, S. C., and Milton Fies, of Birmingham, are consulting engineers.

At Cornelia, Ga., a million dollar lumite plant being built for the Chicopee Mfg. Corp. is nearing completion. Occupying a 330-acre site, the mill will utilize conventional textile mill equipment for production of the lumite fabrics and insect screen. The mill provides about 55,000 sq. ft. of floor space for operation. It will be a one story structure with a 60-ft. ceiling, the front and two sides containing continuous thermopane windows with spun glass insulation in the roof. Floors will be concrete or maple-covered concrete. Building exterior is in buff tile, surmounted by terra cotta trimming around the roof. At the rear of the plant will be a boiler house approximately 40 ft. square with a chimney more than 100 ft. high.

The architect is L. W. Robert, of Atlanta, Ga., and the contractor is Charles Daniel Co., Greenville, S. C.

At Cranford, N. J., Johnson & Johnson Co. has announced plans for a $1,250,000 plant for the production of baby products. On a 30 acre plot, the plant will be single story, 250-ft. by 315-ft. The structure is so built that a four-way expansion will be possible without interfering with the original manufacturing area.

The building will have a single entrance, through which all employees, executives and visitors will pass. From the 25 ft. by 35 ft. modern reception lobby, visitors will be able to look out upon the manufacturing operations through a large plate glass window. A feature will be storage of raw materials and finished goods in one large warehouse section, thus providing flexibility with raw materials next to the processing equipment and packaging lines, and finished goods stored next to shipping facilities.

The structural frame is of steel, and all bays are standard 15 ft. by 35 ft. The architects are the Ballinger Co. of Philadelphia, Pa., and John A. Johnson & Sons, Brooklyn, N. Y., are contractors.

Arkansas holds its largest highway letting

Reported to be the largest letting, in dollar volume, in its history, the Arkansas State Highway Department on Mar. 4 received low bids on 14 projects totaling $2,484,400 covering 108 miles of highway construction. Contracts have been awarded the low bidders on two of the projects to be constructed entirely with state funds, and tentative awards have been made to the low bidders on the other 12, which are federal aid projects, pending concurrence of the Public Roads Administration. All bids were rejected on one other advertised project, as they were in excess of the engineers' estimates.

Calendar of Meetings

NATIONAL

American Water Works Association, annual convention, Municipal Auditorium, St. Louis, Mo., May 6-10.

President's Highway Safety Conference, Washington, D. C., May 8-10.

REGIONAL

Illinois-Indiana Section, Society for the Promotion of Engineering Education, University of Illinois, Urbana, Ill., May 11.

New England Sewage Works Association, Pickwick Arms Hotel, Greenwich, Conn., May 17.

Pacific Northwest Sewage Works Association, Gearhart Hotel, Gearhart, Ore., May 22.

Pacific Northwest Section, American Water Works Association, Gearhart Hotel, Gearhart, Ore., May 23-24.

New York State Sewage Works Association, spring meeting, Hotel Hamilton, Utica, N. Y., May 24-25.

North Carolina Waterworks Operators' Association, annual operators' training school, Chapel Hill, N. C., June 10-15.

Reclamation Bureau asks Angostura Dam bids

The stage was set for construction of the first South Dakota unit of the huge Missouri Basin reclamation program when a call for bids for the erection of Angostura Dam, on the Cheyenne River, was announced at Denver, Colo. Bids will be opened at the bureau's office in Hot Springs, S. D., May 22.

Angostura Dam, about nine miles south of Hot Springs, will create a reservoir with a capacity of 200,000 ac.-ft. of water for irrigation, silt control, and recreational purposes. The structure will be a concrete gravity-type dam with a height of 150 ft. above the river bed, and a crest length of approximately 1,600 ft. A quarter-million cu. yd. of concrete will be required for construction of the dam which is expected to get under way this summer.

The beginning of construction to harness the rivers of the Missouri Basin, one of the biggest engineering jobs of all time, signals the inauguration of a long-range program to banish major droughts and floods (*ENR* April 18, vol. p. 527).

A contract for the construction of Kortes Dam and power plant on the North Platte River in Wyoming, was recently awarded to the Morrison-Knudsen Co. of Boise, Idaho.

Canadian bridge fire blamed on cigarette

The spectacular fire that damaged the 45-year-old Alexandra Bridge across the Ottawa River between Ottawa, Ont., and Hull, Que., apparently was caused by a burning cigarette thrown on the deck of the downstream highway approach at the Hull end, preliminary engineering surveys revealed last week.

The 1,886-ft. bridge was badly damaged March 29 (*ENR* April 11, vol. p. 520), when high winds drove sparks across the bridge deck and into an adjoining lumber yard.

Examination of the bridge by engineers of the Canadian Pacific Railroad indicated that damage was caused to about 40 percent of the bridge deck and floor system. This damage was distributed as follows: 240 ft. of the Hull approach, 140-ft. span, a 247-ft. span, and five panels—approximately 150 ft.—of the cantilever arm at the Hull end. Repairs to the structural portion of the bridge will involve replacing a large portion of the floor system on the damaged span and the addition of some reinforcing to other parts of the bridge. New deck will be required over the entire damaged area. The cost of repairs is estimated at $350,000.

OBITUARY

William MacIntire White, Sr., 73, a civil engineer with the American Bridge Co. for 43 years and contract manager of the New York office for 20 years, having retired in 1938, died at Fanwood, N. J., April 25. He was a graduate of the University of Pennsylvania. Some years ago, on leave of absence from his company, he went to Peru to examine 65 bridges for the installation of heavy rolling equipment on the country's railroads, and in 1908 he was sent to China to design railroad bridges.

Freeman Francis Wetmore, 85, retired civil engineer of Lumberton, N. C., died April 23. A native of New York, he did surveying and engineering work for railroads in several Western states before going to North Carolina to engage in engineering work there and in South Carolina, Virginia and Georgia.

Walter E. Standeven, 65, civil engineer, died in Omaha, Neb., April 21. A graduate of the University of Nebraska, for many years he was active as an engineer for federal power and irrigation districts in Nebraska. He was also an engineer for many paving projects in Nebraska and Iowa.

Andrew Miedwig, industrial engineer of United Engineers & Constructors, Inc., Philadelphia, Pa., and with that firm for 24 years, died recently. He was a graduate of Baltimore Polytechnic Institute, 1907, with a C. E. degree, and took two years of graduate work at Johns Hopkins University.

Mr. Miedwig started his engineering career in 1909 as a structural designer with Baltimore Bridge Co. and later was with Carnegie Steel Co., Baltimore. In 1918 he became structural engineer with the construction division of the War Department and prepared plans for many of the war plants built during World War I. Since his association with United, he had been in charge of the design of many industrial projects.

M. S. Steadman, 48, of Decatur, Ga., an engineer's assistant in the Georgia State Highway Department and with the department for nearly 25 years, died on April 2.

Charles S. Nichols, 62, Miami, Fla., city engineer, died on April 19. A civil engineering graduate of Iowa State College in 1914, Mr. Nichols was formerly with the Iowa Highway Commission and later was professor of civil engineering at his alma mater. He had directed the building of more than $10,000,000 of civic projects in Miami.

Charles G. Kershaw, 77, founder of the C. G. Kershaw Contracting Co., Birmingham, Ala., and its president and principal owner until his retirement in 1937, died recently at his home near Fort Payne, Ala.

William Osborn, 66, state road commission engineer of Utah, died at Provo April 8. He had joined the Utah road commission as engineer in 1924.

T. H. Weaver, 41 of Rutherfordton, N. C., district manager of the Duke Power Co., died April 26. He was graduated in civil engineering from the University of North Carolina in 1926 and before joining the Duke Power Co., as a highway engineer, was director of the University of North Carolina water system and later served as resident engineer of the Beaver Dam water and sewer system at Asheville.

Howard F. Herzog, 44, president and founder of the Central Engineering Co., Milwaukee, Wis., died April 21.

Walter G. Worden, 71, president of Croinor Pershing Mines and vice-president of Citralam Milartic Mines of Canada, died April 19. Mr. Worden was graduated from the University of Toronto in 1912. Subsequently he was appointed city engineer for Oshawa, Ont. Later he joined the Dufferin Construction Co.

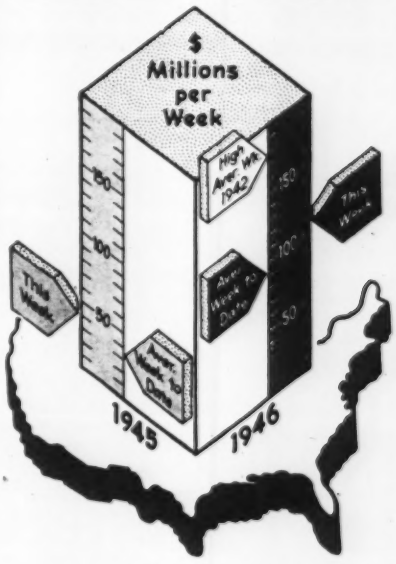
Frank Gordon Fahnestock, 88, a retired civil engineer of the Bethlehem Steel Co., died April 25. Prior to his transfer to the Steelton plant, he was with the Sparrows Point, Md., plant.

Bernard Ransome, 72, president of the Ransome Co., of Emoryville, Calif., general contractors, died April 23 at Mt. Diable, Costa County, Calif. He built many of the state's first highways, particularly those in the San Joaquin Valley, and also was active at the time of the 1906 earthquake and fire in helping to rebuild San Francisco.

Correction

In *ENR* April 4, it was stated that contractors in Rochester, N. Y., have been paying labor $1.15 an hour. The Mason-Carpenter Contractors Association, Inc., which makes the only agreement covering rates for labor in that area has been paying $1.00 an hour under a 1945 decision of the Wage Adjustment Board. With the laborers' union it made a joint application to the Wage Adjustment Board for approval of a 15-cent increase, but that has not yet been granted.

CONSTRUCTION ACTIVITY



As Reported this week to . . .
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of May 2 1946	Cumulative 1946 (18 wks.)	Cumulative 1945 (18 wks.)
Federal	$11,345	$184,625	$321,284
State & Mun.	28,059	369,302	69,197
Total Public	$39,404	$553,927	$390,481
Total Private	69,405	1,071,355	170,681
U. S. Total	**$108,809**	**$1,625,282**	**$561,162**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Type of Work	Dollar Volume (Thousands) This Week	Cumulative 1946 (18 wks.)	Cumulative 1945 (18 wks.)
Waterworks	$470	$33,836	$12,568
Sewerage	1,028	20,291	10,433
Bridges	4,574	40,034	8,302
Highways	21,326	204,864	46,621
Earthwork, Waterways	4,561	102,089	12,519
Buildings, Public	2,153	100,741	229,790
Industrial	15,317	352,094	120,912
Commercial	52,172	647,612	29,532
Unclassified	7,208	123,721	90,485

NOTE: The sharp rise in construction costs would bring smaller projects into the *Engineering News-Record* reports and statistics than they were intended to include if the minimum values reported were kept constant. To continue reporting the same physical size of projects, the minimum dollar values will be adjusted, effective May 1, 1946, in direct ratio to the *Engineering News-Record* Construction and Building Cost Indexes. Minimum dollar value of projects included will be raised: Waterworks and waterway projects from $15,000 to $22,500; other public works from $25,000 to $40,000; industrial buildings from $40,000 to $55,000; other buildings from $150,000 to $205,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1946 (18 wks.)	Cumulative 1945 (18 wks.)
NON-FEDERAL	$320,628	$212,703
Corporate Securities	134,239	49,259
State and Municipal	186,389	142,544
RFC Loans	.....	20,900
FEDERAL	158,320	77,137
Total Capital	$478,948	$289,840

EDITORIALS

VOLUME 136 NUMBER 18

May 2, 1946

Conversions for Quick Homes

ALTHOUGH the Wyatt housing program carries an "emergency" label, its implementation will impinge on a good many long-time activities—materials research, building code modernization, development of prefabrication techniques, labor relations, zoning and city planning, for example—so that there should be a clear separation of thinking on the two objectives from the very first. Otherwise, the long-time activities, good in themselves but extracurricular to quick emergency house building, may block our vision. Indeed, this tendency has already been marked in the modest goals set up for housing units through conversion and remodeling. The 50,000 such units planned per year might readily be tripled, according to some estimates. If these be even approximately correct, greater emphasis on conversion is the way to quick homes for those needing immediate shelter. And separating such emergency measures from the more permanent objectives, moreover, will permit attainment of these objectives on a sound, lasting basis. The Wyatt housing program offers the opportunities. They should not be missed by scrambling our efforts.

Brooklyn Bridge Report

TWO FACTS DESERVE to be emphasized with respect to a report rendered last year by a board of consulting engineers to the New York City Department of Public Works on a technical survey of the Brooklyn Bridge and recently published in book form. First, it presents a mass of technical data not only in the logical, complete manner expected of engineers, but in a style combining a minimum of verbiage with such effective emphasis of important points and their technical and economic meaning that it becomes an exciting, meaningful story. Second, it is published in book form so that it represents a permanent addition to available engineering literature. For the first characteristic the profession owes thanks to the consultants, O. H. Ammann, the late Holton D. Robinson and the late Leon S. Moisseiff, and for its publication in book form to Homer R. Seely, deputy commissioner, New York City Department of Public Works. Because the Brooklyn Bridge is an American heritage, every engineer should know it intimately—its history, its record of service and its possibilities for more years of usefulness. From the technical survey it is learned that the handsome stone masonry towers are in excellent physical condition, and that the anchorages and the cables are likewise satisfactory for long years of use. Even the stiffening trusses show little deterioration although, for unrestricted use of the bridge by truck traffic, they would have to be replaced. This report, coming so soon after D. B. Steinman's notable biography, "The Builders of the Bridge", does much to round out our knowledge of Brooklyn Bridge and guide the city in safeguarding its future. Too few engineering reports reach these standards of excellence and usefulness.

Subdivide the Road Jobs

BIDS ON HIGHWAY WORK continue to be so few as to indicate lack of any real competition in many instances and so high in others as to raise question concerning the advisability of letting the contracts. Pennsylvania recently received bids on some large contracts that were 80 to 100 percent above prewar costs; New York got no bids at all on a large amount of work near Rochester. Such a condition is serious; it is delaying badly needed work, and is slowing up the expansion of construction activities that is so essential to a well-balanced economy. Its causes are complex, but a major one is uncertainty as to the future supply and cost of both labor and materials. This uncertainty cannot be eliminated quickly. There are, however, indications that it can be mitigated by subdividing proposed highway projects into small contracts that can be completed in a few months. Bidding on jobs of this kind has been much more favorable than on large jobs. The use of such a plan, obviously, would put more work on the highway departments, but if it gets the work under way and cuts the cost it would be well worth the effort.

Apprentice Training

MANY YOUNG VETERANS, particularly those who have served in the Seabees and Army Engineers, have acquired skills in construction that can profitably be used in all branches of construction. These young men are anxious to complete apprentice training leading to full journeyman status. Now, while we are just starting on a decade of intensive construction, when the number of journeymen in construction is low and the average age is relatively high, it seems

most desirable to increase materially the apprentice training in every construction craft. Some of this will be provided under the "G. I. Bill of Rights," and every effort should be made to encourage young men to take advantage of it. Over and above this the labor unions have a responsibility and an opportunity to enlarge their own apprentice programs. Fortunately some have already taken steps in this direction, and it is to be hoped others will follow. A healthy construction industry means too much to our national economy to permit it longer to suffer from shortages of skilled craftsmen. The need for large-scale apprentice training must be met, and quickly.

Challenging Water Supply Needs

STRENUOUS as were the efforts of the waterworks profession to expand and maintain service during the war years—during which, incidentally, every obligation was met—even more challenging problems lie ahead. Many cities, for example, are finding that peak loads of wartime show little reduction, and that both domestic and industrial consumption demands continue at unusually high levels. Meantime, there is good prospect that heavy extra demands will result from the housing program.

Instead of a "breathing spell," during which there would be opportunity to catch up on deferred maintenance and proceed with normal expansion programs, waterworks engineers and manufacturers continue to be hard-pressed for immediate action. Yet, with the possible exception of manpower, conditions so far as materials and construction facilities are concerned are little better than during the war. One index of the backlog of work is furnished by *Engineering News-Record* statistics showing some $938 million of proposed new projects. Significantly, only $33 million of this work was under way in the first four months of this year. There are many reasons why there was not more, perhaps the most obvious being the present high cost of construction and the lack of adequate materials. Nevertheless, water service must be continued.

Faced with this dilemma, waterworks men gather in St. Louis next week, for their first convention in two years. While this meeting cannot hope to solve the economic and political ills of the nation that are at the root of present difficulties, it will offer opportunity for devising specific adjustments to conditions so far as water service is concerned. That adjustment to conditions with resulting progress can be made is evidenced in part by the section on current waterworks developments featured in this issue. Here will be found some examples of what is being done to cope with demands. This exchange of ideas and the discussions at St. Louis should be helpful in promoting the installation of urgently required water supply improvements.

Higher Pay for Engineers

ALTHOUGH the subject of pay for engineers in public service has come up for discussion frequently during the past few months, the urgent need for higher wage scales in this field cannot be restated too often. State highway departments, for example, are up against a seemingly insurmountable barrier to increasing wages sufficiently to retain their present employees or to attract the additional competent men needed in all branches of construction. Thomas H. MacDonald, Commissioner of Public Roads, at the recent meeting of the AASHO in Oklahoma City, pointed out that the yearly salary for chief engineering officers starts as low as $4,500; that for state highway bridge engineers it begins at $3,600, and for chief construction engineers at $3,360.

Obviously such low salaries are nowhere near in keeping with the degree of responsibility assigned these men. Much the same can be said for other types of public service and for lower categories of responsibility. If this situation is to be remedied, legislatures must be shown that higher salaries are in the public interest.

Studies made by Allen P. Richmond, Jr., assistant to the secretary of the American Society of Civil Engineers at the request of some of the state highway commissions point the way to bring these conditions to public attention. Systematized classifications of positions and salary scales prepared by Mr. Richmond have eliminated many inequities and have laid the groundwork for further increases in line with compensation for private work.

This work of the American Society of Civil Engineers and that of some of the state societies of professional engineers needs to be extended into other fields of engineering activity. And if it is to be effective it needs active support.

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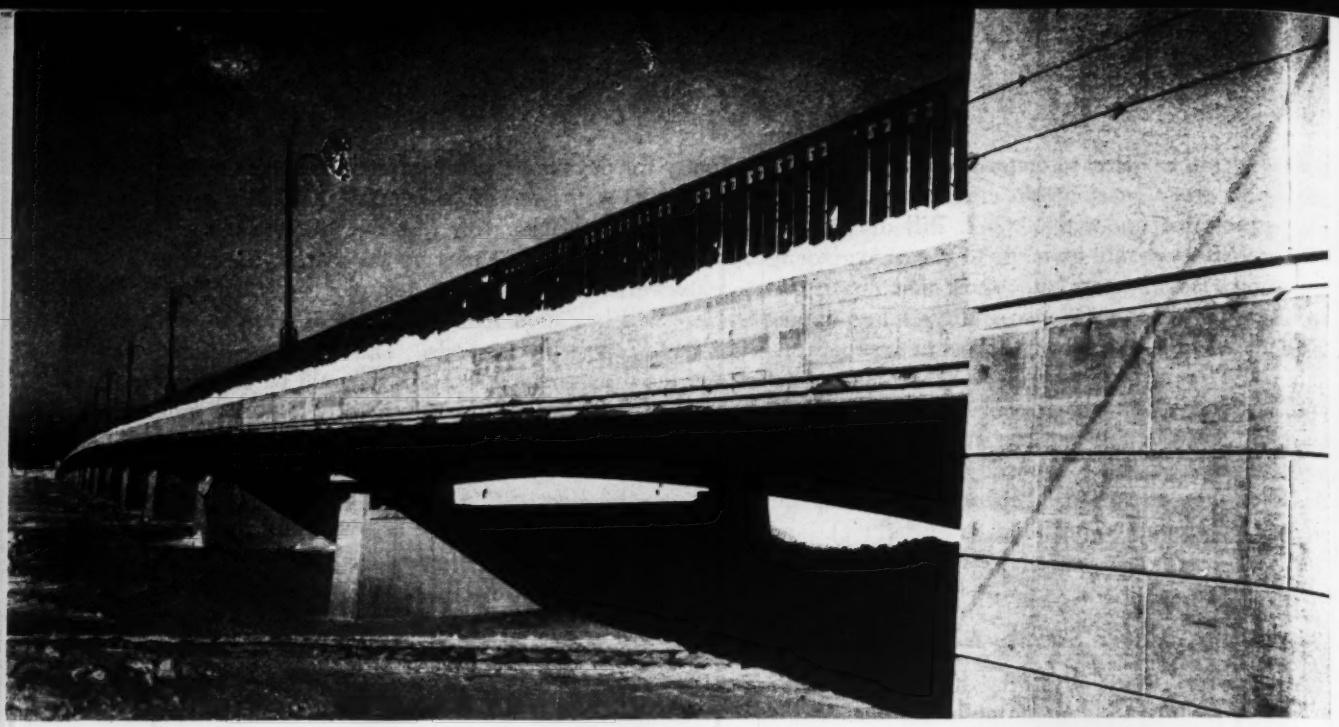


Fig. 1. Concrete fascia and ornamental wrought iron railing are distinguishing characteristics of the St. Rose Bridge.

Welded Girder Bridge is 1,500 ft. Long

D. B. Armstrong
Designing Engineer, Dominion Bridge Co., Ltd.
Montreal, Canada

***Contents in Brief**—Believed to be the longest welded continuous-girder bridge yet built, the new structure at St. Rose, north of Montreal, contains 14 spans 90 to 126 ft. long, totaling 1,500 ft. in length. Expansion joints are used at ends of bridge only, and the concrete deck serves as lateral bracing. A deep concrete fascia masks the ends of the floorbeams. Stiffeners, used on inside of girders only, except at piers, serves also as floorbeam seats. Special welding procedure used at field joints to avoid buckling from locked-up stresses.*

CANADA began its postwar bridge building program by completing, during 1945, ready for official opening this spring, what is believed to be the longest welded-girder bridge yet constructed. Known as the St. Rose Bridge, its 14 spans stretch in one continuous length for 1,500 ft. across the River des Milles Iles about 15 miles north of Montreal on the main highway to the famous Laurentian Mountain resort area. The new bridge replaces a remarkable old wooden bridge on rock-filled timber cribs, which has been in constant service since its erection about 1830, soon after its charter was granted by King William IV of England.

Individual spans of the new bridge vary from 90 to 126 ft. long, and they are arranged symmetrically about and fixed at the center pier; all other bearings are carried on expansion rollers. The girders are spaced 32 ft. apart and carry a 52-ft. 8-in. concrete deck, which accommodates a 42-ft. roadway and two 4-ft. sidewalks. The roadway is designed for two 25-ton or four 20-ton trucks abreast, or alternately, for 100 lb. per sq. ft. of uniform load.

A feature of the design is the utilization of the concrete deck as the lateral bracing system, which adds an element of economy to that inherent in the welded steel. The use of continuous construction also aids economy since it eliminates the necessity for duplicate pier members, floorbeams and sway-bracing at each pier, and what is more important to the motorist, it provides a smooth roadway surface unbroken by the customary and often troublesome intermediate expansion joints. Other features of interest are the ornamental fences and lamp standards, the deep concrete fascias masking the ends of the floorbeams and the absence of exposed girder stiffeners, except over the piers.

Welded-girder structures in Canada, of the type that has reached record dimensions at St. Rose, date back to 1936 when a steel continuous-girder bridge (*ENR* Jan. 14, 1937, p. 52) was built to replace an obsolete three-span truss bridge at Ste. Anne de la Perade, a town on the Montreal-Quebec highway. The prime requisites in this instance, as for most bridges in settled districts, were pleasing appearance, maximum clearance over the water and freedom from overhead obstruction. In particular, it was desired that the view of the impressive parish church of this old Quebec town should be unimpaired. Though the first of its kind

to be erected in Canada, no trouble of any sort in fabrication or erection of this bridge was experienced, while the final costs proved to be very satisfactory compared to a riveted structure of much less esthetic value.

The success of this first 645-ft. continuous welded bridge soon led to the placing of further bridge contracts by the Quebec Provincial Government, which was quick to realize the advantages of continuous welded construction in providing bridges in harmony with picturesque surroundings.

In 1937, a graceful deck-bridge of three continuous welded-girder spans, 255 ft. in length, was erected at Louiseville, another town between Montreal and Quebec. This was followed by a bridge of five continuous spans, 485 ft. long, across the Becancourt River in this same year, which also saw the erection of a five-span 640-ft. bridge across the Rouge River at Calumet. Other continuous welded bridges included a slender three-span construction across the Lievre River at Buckingham, and the approach to the swing span of a crossing of the Richelieu at Beloeil. The St. Rose Bridge thus represents continuation of a trend that was interrupted by the war.

Structural details

As is evident from Fig. 1, the deck of the St. Rose Bridge (8 in. thick in the roadway and 6 in. in the sidewalks) rises on a vertical curve to a height of 8 ft. at the central pier, the top flanges of the girders being parallel to this curve, and the bottom flanges being arched to provide maximum possible clearance for the small pleasure craft using the river. The curved arches also add to the pleasing appearance of this bridge.

The girders vary in depth from 9 ft. at the central pier to 4 ft. 7 in. in the 90-ft. shore spans, and their 22-in. flange plates vary in thickness from $2\frac{3}{4}$ to $1\frac{3}{8}$ in. Web plates $\frac{3}{8}$ in. thick are used throughout, with heavy plate stiffeners over the bearings and only inside stiffeners at intermediate points. The latter consist of 6 x $3\frac{1}{2}$ x $\frac{5}{16}$-angles, toe-welded to the webs and calculated to provide buckling strength equivalent to conventional double-angle stiffeners.

Every second stiffener is cut and capped to form a seat for the floorbeam, which is faced to bear and is welded to the girder web for shear only. The welded cantilever brackets are similarly faced, welded for shear only and connected to the floorbeams by tension straps over the girders.

The girder bottom flanges are braced by knee brackets from every floorbeam in the compression zone, and from alternate floorbeams elsewhere. Over the piers the floorbeams are deep, welded, girder sections also proportioned to act as brace frames adequate for all lateral forces. No permanent top or bottom laterals are provided, the concrete deck being calculated to resist all lateral loads. Light temporary diagonals were installed for aligning the girders during erection, but were removed after the concrete deck had been poured.

Fig. 2. Welded steelwork and the utilization of the concrete deck slab as lateral bracing contribute unusual simplicity and clean-cut lines to the framing of the St. Rose Bridge. Stiffeners are used only on the inside of the girders except at the piers.

Fig. 3. St. Rose Bridge, on the route to the Laurentian Mountains in Quebec, provides a 42-ft. roadway for traffic as well as two 4-ft. sidewalks for local pedestrians.

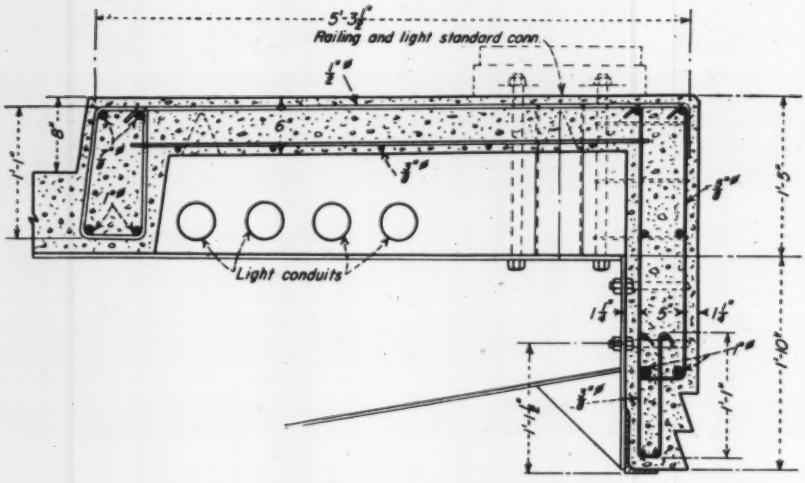


Fig. 4. To mask the ends of the sidewalk brackets a concrete fascia is used, poured monolithic with the sidewalk and roadway slabs.

At the abutments, flush roadway expansion joints of the over-lapping finger type provide for a total movement of 9.7 in. for half the bridge, equivalent to a temperature range from —40 deg. to 120 deg. F. for a length of 775 ft. They are heavily anchored into the adjoining concrete to resist tension in case of sudden freeze-up when ice formation might otherwise cause trouble.

The pier members which support the girders are provided with disk bearings for equalizing the loads and have rollers varying from 5⅜ to 6⅝ in. in diameter. The rollers are mounted in completely enclosed roller nests, and the direction of their motion is positively controlled by pintles set in the shoe and bed plates and engaging the center roller, the whole assembly being readily accessible for inspection.

In the design of the girders, calculations of moments and shears were based on the moment-distribution method adjusted for variable moments of inertia. The section modulus in the 90-ft. spans varies from 2,010 in.^{3} to 5,010 in.^{3}, and in the 126-ft. spans from 1,910 in.^{3} to 6,830 in.^{3} Field joints were located as close as practicable to points of least moment in each span, the girders of the longest spans being fabricated in lengths of 67 ft. 6 in. and 58 ft. 6 in., the corresponding weights being 16½ and 11½ tons.

Full-length flange plates of the required sizes not being available from Canadian mills, thinner flange plates were introduced on either side of the field splices, resulting in a saving of material and reduced field welding, which largely compensated for the additional shop work.

For simplification in detailing and fabricating the girders, since both flanges are curved, straight working lines were established from pier to pier, and all girder offsets, floorbeams, stiffeners and field splices were located normal to these lines excepting at the piers, where vertical lines were used.

The total weight of structural steel in the bridge is 1,180 tons, representing 1,520 lb. per linal foot of bridge, exclusive of handrails and lamp standards.

In fabrication, the web plates were first laid out and flame-cut to correct profile, including dead load camber allowance, then all web details were welded in place. Flange plates were butt-welded, pressed or rolled to curvature and then assembled to the webs and squared by temporary braces.

Fig. 5. Welding a knee bracket, which will serve as both a stiffener and a floorbeam support at the pier. The girder shoe is provided with disk bearings that ride on rollers in an enclosed box easily opened for inspection.

Continuous fillet welds were applied alternately to top and bottom flanges in a sequence that limited overall vertical distortions to a maximum of ⅛ in. The flanges and web plates, which had been left long, were then flame-cut to final length and prepared for field welding. Adjoining girder segments were progressively shop assembled in correct alignment on the flat, and field splice holes drilled from steel templates, which were also used for drilling the temporary field splice plates, thus assuring correct field assembly by means of pins.

In the field, erection was from south to north, using a stiffleg derrick traveler and an adjustable portable steel bent for supporting the central girder sections of each span until the pier sections were landed. Material for the south half of the bridge was transported over a narrow gage service track laid on the deck, but later, to allow pouring of the concrete to commence, steel was conveyed to the head end on scows.

Field welding procedure

Girder sections were assembled, relying entirely on the pinned erection splices for accuracy of alignment since it was impractical to calculate in advance the correct elevation of the partially strained members. Levels taken after seven spans had been erected, and subsequently, indicated an extreme error in elevation of ⅝ in. in the first span and less than ⅜ in. in any other.

Field welding began after the third span had been assembled, and throughout was kept three spans behind the erection. All welding was done by qualified operators from scaffolds designed to allow freedom of motion and accessibility.

The original welding procedure for the girder splices called for welding to commence at the center of the web plates, proceeding outward to the flanges, followed by butt welding of the flanges. This procedure was changed when web buckles appeared during the flange welding operations, apparently due to a release of locked-up stresses when the top splice plates on the flanges were removed to permit welding. These buckles were elimi-

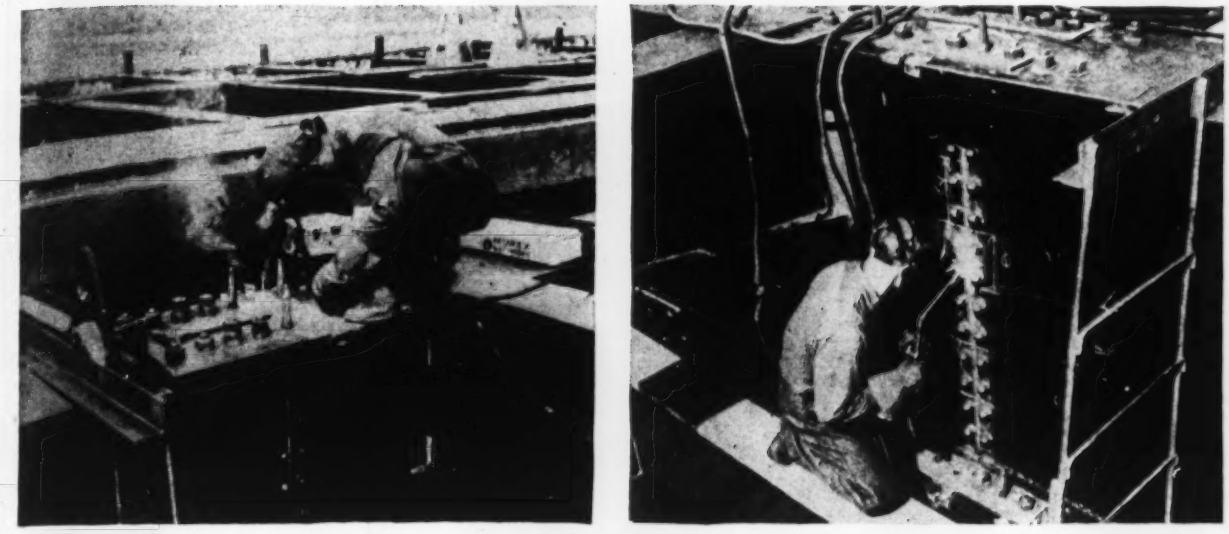


Fig. 6. Welding of the girder field splices required a special sequence of operations to eliminate locked-up stresses. First, the flanges were butt-welded, then 12 in. of the web from both top and bottom. Next the flange plates were welded on and finally the remainder of the web joint was completed.

nated, after the flange welds had been completed, by flame-cutting the webs and re-welding them.

The procedure then adopted was to butt-weld the flanges, partially weld the web for a distance of 12 in. from top and bottom, complete the flange welds and then the web, the object being to balance as far as possible the longitudinal contraction, which amounted to $\frac{5}{32}$ in. per joint. Splice holes in the flanges were simply filled with plugs and welded over since the net areas were more than ample for the calculated stresses at these points. Bolt holes in the web plates were, however, completely plug welded for appearance.

Foundations and deck construction

All piers and abutments were carried to rock or were supported on heavy steel H-beam piles driven to rock. The rock consists of limestone or shale with an overburden varying from nothing to 40 ft. of unstable Leda clay located at the north abutment. Open cofferdams of steel sheetpiling were used in the construction of all piers, the piling being later burned off 3 ft. below water level. The cofferdams were completely unw ..red before pouring concrete.

Concrete for the roadway, sidewalks and fascias was poured monolithically and in sections that extended between points of dead load contraflexure in the girders and that varied in length from 54 to 72 ft. Forms were of the panel type using 1¼-in. lumber dressed to 1 in. and nailed to 2 x 6 or 2 x 8-stringers, which spanned between the floorbeams.

Concrete was transported from a central mixing plant in 1½-cu. yd. side-dump cars hauled by gasoline locomotives operating on a narrow gage railway. The deck contains 2,200 cu. yd. of 3,000-lb. concrete and was poured in 27 sections at the rate of one section per day.

No longitudinal or lateral construction joints whatsoever were provided in the deck, since previous experience had indicated difficulty in maintaining such joints in the severe Canadian climate. Moreover, it was considered that sufficient bond existed between the steel and concrete to provide for temperature differential betwen the two.

The St. Rose Bridge was built by and for the Department of Public Works of the Province of Quebec. The Dufresne Engineering Co., Ltd., of Montreal, acted as agent for the province and as such was general contractor of the project, responsible for the design and construction. The dominion Bridge Co., Ltd., was contractor for the fabrication and erection of the structural steel. Baulne & Leonard, of Montreal, were retained as consulting engineers by the province.

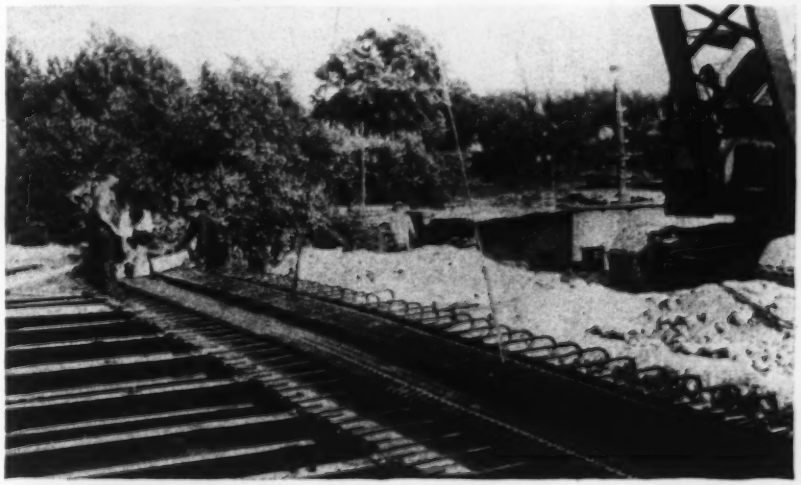


Fig. 7. Installing a finger-type expansion joint at one of the abutments. Elsewhere no joints of any kind interrupt the continuity of the roadway.

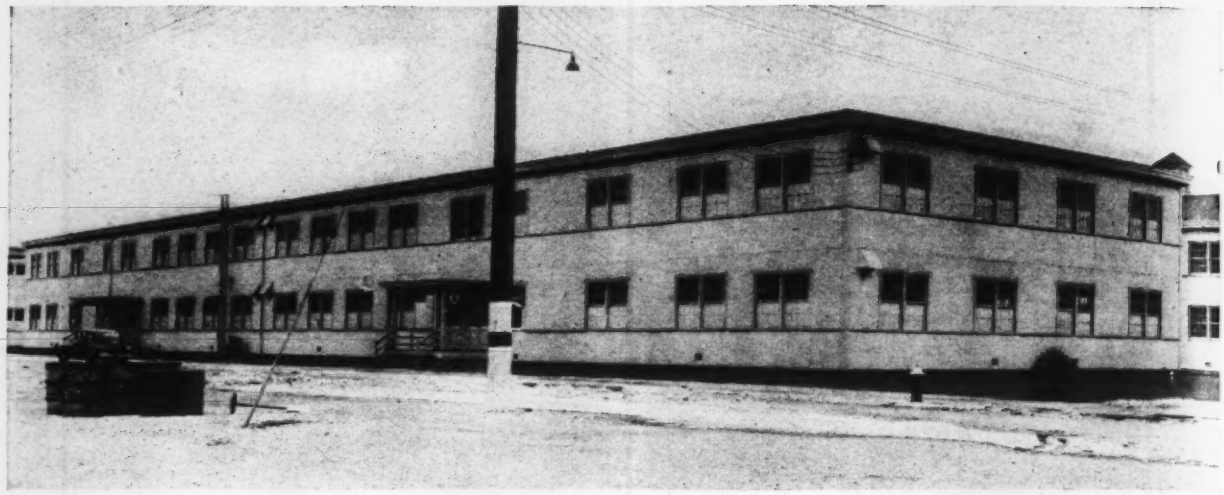


Fig. 1. Bright paint and more shrubs are to be used to eliminate usual drab appearance of military barracks.

Converting Barracks Into Livable Homes

Clyde C. Roth,
Project Manager, George A. Fuller Co.
New York, N. Y.

***Contents in Brief**—Existing military barracks are being quickly converted to homes with a minimum use of critical material, thus alleviating to some extent the current housing shortage. Essential utilities—water, lights, streets and sewers—are ready for use. Many items from barracks are being salvaged and utilized for dwellings. Bright paint and shrubs help to make it home.*

SOME of the emergency housing that is necessary can be provided most readily and with minimum requirement for scarce materials by utilizing, in their present location, existing military barrack and camp facilities near areas requiring dwellings immediately. Most of the camps are located on sites that are better than those that are available for temporary housing but they usually are more remote from areas where housing is most needed. However, by addition of some bus facilities, many existing camps near the larger cities can become possibilities for emergency housing.

In general, necessary utilities already are installed, streets are surfaced and the site is in good condition with at least some landscaping. Water supply and disposal plants, fire stations and heaters already are in service. Consequently, better housing can be provided quicker in presently unused camps than by other means. Moreover, such camps can be made attractive, livable homes at little added expenditure by careful planning of details.

A start in New York

While many states and communities have done little more than worry about the housing shortage, the state of New York, through its Housing Division, conceived and is executing a well coordinated plan to convert surplus military structures into exceptionally livable apartments and dwellings. The initial project in this conversion was the former Manhattan Beach Coast Guard Training Station (*ENR*, Sept. 9, 1943, vol. p. 382) facing on the Atlantic Ocean two miles east of Coney Island in Brooklyn, N. Y., lease on which was obtained upon declaration by the military branches of the government that some barracks would become surplus.

In spite of the critical shortage of building materials and the scarcity of mechanical equipment such as radiators, ranges, refrigerators, sink cabinets, shower stalls and similar items, more than 500 dwelling units have been made available since this project was started in January 1946. Plans for the conversion and design of the dwelling units were made by Alfred Hopkins and Associates, architects, designers of the training station, and construction has been done by the George A. Fuller Co.

The barracks at the Coast Guard Station, and similar structures available for conversion elsewhere, contain many items that can be used successfully in the layout and equipping of apartments. For example, the number of enlisted men assigned to a barracks was greatly in excess of the number of persons to occupy the same structure as dwellings. Consequently, plumbing fixtures and accessories not only

are available but in some cases an excess exists of such items as lavatories, toilets, mirrors, slop sinks, and glass shelves.

When the work of conversion started, one of the first activities was to remove all plumbing fixtures from the building to a warehouse. Here the fixtures were checked in, repaired and cleaned. Some fixtures, such as hotwater tanks and low-tank toilets required testing before they could be re-installed. After cleaning and test they were logged in a warehouse ledger and reissued for final installation.

The Coast Guard barracks contained a great number of seamen's wood lockers. It was found that these could be economically reframed on the site into dish cabinets and broom closets for the kitchen and medicine cabinets for the bathroom. This reframing resulted in the salvage of a considerable amount of ⅝-in. plywood, which was utilized as shelving for built-in closets.

All lumber obtained from the removal of existing partitions in the barracks was reused for partitions in new locations. When lumber thus salvaged was found unsuitable for studding, it was cut into short lengths for framing.

Fig. 2. Interior of original barracks after tier bunks were removed. Seamen's wood lockers were utilized for dish cabinets and the like.

Utilities usually adequate

Except in abnormal cases, military structures are adequately heated, so that a rearrangement of the heating facilities is all that is necessary. Light and power lines also are adequate unless an abnormal load is added by electric ranges and refrigerators. Waste and water lines are of sufficient size as the population of the converted barracks will be under that of the original structure.

Heating of open barracks usually is accomplished with unit heaters. This type of heating is not adaptable to apartments and the units ordinarily are removed except in the corridors. The fin-type, individual apartment radiators are a convenient substitute.

By laying out apartments so that kitchen facilities and bathroom fixtures are back-to-back, piping in a single wall serves both. In two-story structures apartments are arranged one over the other so that single risers will supply both.

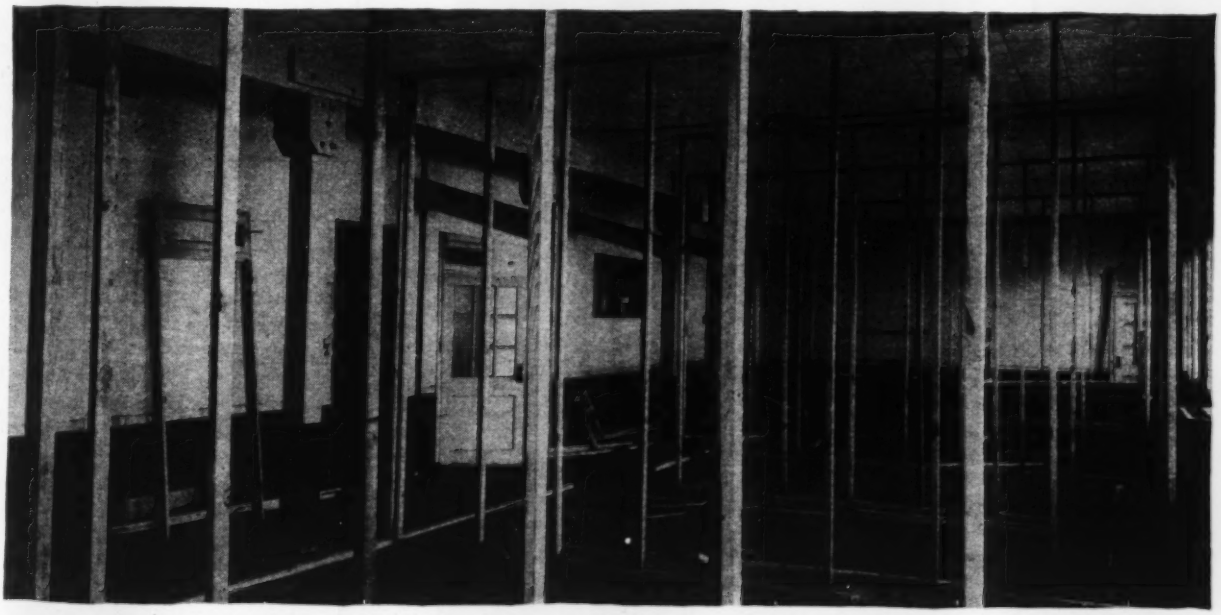


Fig. 3. Wallboard on both sides of wood studding is used to convert large barracks room into two-room apartments.

In the Manhattan Beach project the best practical layout places the bathroom near central corridors and requires forced ventilation. This is accomplished by use of metal duct to centrally located exhaust fans. The forced draft arrangement also serves to ventilate the kitchen portion of the apartment, located near the bath.

Soundproofing between apartments

Partitions constructed of wood and faced with wallboard are frequently the most economical materials for barracks conversion. Soundproofing of walls within an individual apartment is not deemed essential but it is necessary between apartments.

To insure adequate soundproofing at Manhattan Beach, all studding forming an apartment partition was faced on each side with felt cut in strips 2 in. wide. Wallboard was then placed across one side of the studs, and in the recess so formed rock wool blankets were placed. After the rock wool was secured in place, the second face of wallboard was installed. Tests indicate that this form of soundproofing is sufficient under normal circumstances.

Soundproofing between first and second floor apartments is especially desirable. However, the barracks at the former Coast Guard station were exceptionally well built originally, with mastic tile over wood floors and acoustic material on the ceilings. These sound insulating features are maintained in the apartments.

Some form of vermin prevention is desirable as partitions are built. This will eliminate not only any vermin and rodents resulting from previous occupation, but also reduces or eliminates rodents that might be attracted by lunches of workmen on the project. The preventative method used at Manhattan Beach consisted of spraying all studding that forms new partitions and thoroughly spraying all openings in existing exterior walls and stair halls.

It is advisable to arrange with the firm doing preventative work to make periodic visits after the structural partitions are built to inspect the building for evidence of vermin or rodents.

Hardware salvaged from the original barracks can, with minor adjustment, be used in apartments. Since the number of doors is greatly increased by the apartment layout, the salvaged hardware must be augmented. If the original locks are master-keyed they should be used on apartment entrance doors. The supplementary hardware may be used on doors within the apartments where master-keying, and even locks, are not essential.

Proper attention must be given to fire escapes and fire protection. Barracks of any considerable length will have fire walls. Any openings in such walls should be equipped with fire doors having fusible links or set in such a way as to insure the doors being closed when not in use. Existing fire escapes must be inspected to see that they conform to recognized standards as there is considerable difference in what is adequate for agile young men and what is necessary for family safety. A fire alarm system should be installed if it does not already exist.

Making barracks into homes

After structural completion the apartment painting to make it a finished home. Selection of colors is of utmost importance, as a careful variation of colors will serve to make attractive a room that of necessity must reflect some temporary construction. It also is advisable to vary shades of color depending upon the exposure, whether north or south. This plan may result in slightly higher painting costs but the result is well worth the expenditure.

Finally, but far from being the least important, is exterior grading, lawns and planting. Regardless of how difficult it may be to obtain a home, complete satisfaction with the home selected is essential to continued happiness. The war is over and men and women do not want to live in barracks. Therefore, it is imperative to camouflage or to reduce to a minimum the resemblance to former military structures. Gay exterior colors help but well planned shrubbery, flagstone walks and a tree here and there lends an atmosphere of seclusion and comfort at a comparatively reasonable cost.

The housing problem is one that concerns a great number of individuals and particularly the returning veterans who, because of difficult duty overseas, has in some cases been unable to adjust themselves to the present situation. For this reason assignment of emergency housing has been confined to the veterans and their families. But by removing veterans from the list of those anxiously looking for homes, the general housing situation will be greatly alleviated.

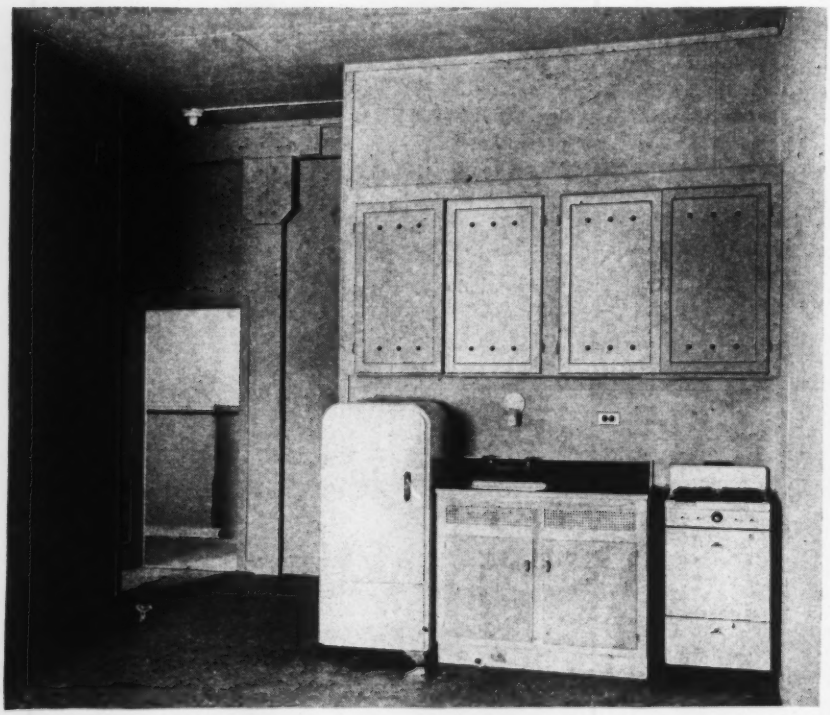


Fig. 4. Saving construction materials has dictated a minimum of interior walls. Compact kitchen, with electric range, is at inside end of living room.

Airfield Paving by U. S. Army Engineers

***Editor's Note**—That a wide range of materials and diverse methods of construction are applicable to the paving of commercial and private airfield runways was proved conclusively by wartime airfield construction in this country. Some of the experiences of the Corps of Engineers, U. S. Army, in this field, were outlined in a paper presented at the recent annual meeting of the American Road Builders Association by Burton J. Bell, Chief, Technical Information Branch, South Atlantic Division. The following is an abstract of Mr. Bell's paper.*

EXPERIENCE gained during the past five years by the U S. Army Engineers in paving airfields throughout the seven southeastern states comprising the South Atlantic Division is not based merely on a few projects involving special conditions. Rather it covers work extending over a large geographical area, subjected to a variety of weather conditions, exclusive of low temperatures, and involves astronomical quantities of paving materials. To be specific the total five-year program included the construction of 40,000,000 sq. yd. of asphaltic concrete runways, taxiways and aprons; and 20,000,000 sq. yd. of sand-asphalt pavements. This asphalt work, together with the required base course construction, cost $87,000,000. During this same period the South Atlantic Division completed 30,000,000 sq. yd. of cement concrete pavement on airfields at a total cost of $75,000.000.

Two important requirements

Viewing this huge construction program in retrospect, two fundamental "musts" stand out above all other requirements for good airport paving. The first is "compaction;" the second, "adequate pavement thickness." If either of these two essential factors must be sacrificed in favor of the other, it should be a slight reduction in pavement thickness rather than lowering the requirements for compaction.

The various types of pavement specified for the several airfields in the southeast depended largely on the supporting power of the subgrade, availability of local materials for base construction and surfacing, equipment available for the work, required speed of construction and the design criteria of the expected wheel loads.

In general, construction equipment used in heavy highway construction proved suitable for the building of these airfields. Some difficulties were encountered at first in securing adequate compaction of aggregates containing a high percentage of Florida sands. Sheepsfoot rollers did not prove satisfactory in this case, resulting in the use of tractors which literally shook the sand into place to secure high density of subgrade; essential in preventing subsequent rutting under heavy wheel loads.

Bases for flexible pavements

Some limerocks in southern Georgia were found to be acceptable as bases for flexible pavements, although the tendency was to use other local materials; pebble soils and clay-gravels being used in that locality with considerable success. In northern Georgia and the Carolinas, the most suitable subbase and base materials available were clay-gravel and sand-clay. In sections of the Carolinas, Tennessee and Alabama, crushed stone was the best material available.

Commercial slags were available in the Birmingham area, but due to high freight rates and the scarcity of transportation, this slag base material was used only to a small extent. Along certain coastal sections, especially the Gulf Coast, decomposed reef and clam shell proved successful as subbase and base material, provided it was placed in sufficient thickness.

Flexible type subbases whether of earth or the above materials were compacted in layer construction to a density of at least 95 percent by the modified AASHO method.

In some areas, "black bases" of asphaltic mixtures were installed to a depth of 5 or 6 in., using both stationary and traveling plants. This type of stabilized base proved satisfactory except for delays due to unfavorable wet weather when using the traveling-plant method of base construction.

In the construction of asphaltic wearing surfaces the following were found to be salient factors: Use of as high a penetration asphalt as possible consistent with required stability; as rich a mix as possible; low mixing temperatures; a designed mix of reasonably high stability; surfaces of low abrasiveness; and tight sealing to prevent the infiltration of surface moisture.

Asphalts having a penetration in excess of 200 were not too successful in the high-temperature areas in southern Florida and along the Gulf Coast. They remained soft too long and the planes tended to displace the surface when turning or parking. Consensus among paving engineers in the southeastern states is that the ideal asphaltic cement should have a penetration between 100 and 120.

Bituminous wearing surfaces included both asphaltic concrete and sand-asphalt. Tar was used for 95 percent of the base course priming, usually from 0.25 to 0.35 gal. per square yard. On some projects the primed bases received a light tack coat of from 0.08 to 0.10 gal. of asphalt per square yard. This tack coat was "fogged" on just ahead of the paving operations.

Hot-mix asphalt best

Best results in the construction of bituminous pavements at these southern airfields were obtained with hot-mixed, plant-produced asphaltic concrete. They consisted of a wearing surface or a combination of wearing and binder courses as required.

The master range of mixing temperature for the bituminous surfaces was from 175 to 250 deg. F. Most contractors, during the latter part of the program, carefully controlled the mixing temperature, with 225 deg. F. being used as a standard on practically all projects.

Conventional asphalt plants with weight-batching units, rotary drum; or those with volumetric proportioning and continuous mixing units were allowed under the U. S. Army Engineer specifications. A graduation-control unit was required for volumetric proportioning plants. Central mixing plants having a rated capacity of 100 tons per hour were used on a number of projects, producing up to 2,600 tons in a 24-hour day.

U. S. Army Engineer specifications in the South Atlantic Division required a density of at least 95 percent of the theoretical maximum density for bituminous surface courses, and 92 percent for binder courses. Runways and taxiways usually were constructed on a one-percent slope from center of runway to the edge.

Properly designed cement concrete pavements for airfield runways, taxiways and aprons proved satisfactory for the heaviest traffic, even on subgrades of relatively low bearing values. However, the wheel load pattern, intensity of loading and dynamic effects of engine warming, made questionable the use of concrete pavement on untreated subgrades of low bearing values.

Concrete pavement generally was preferred for the service portions of aprons and the "turn-around" areas at the end of the runways when bituminous construction was employed elsewhere on the airfield.

In general, concrete slabs were from 7 to 8 in. thick, either thickened at the edges or employing load transfer devices between adjoining slabs. Continuous longitudinal dummy joints were installed at the center of all pavement slabs having a width of 15 ft. or greater.

Construction, expansion and dummy joints were used in all cement concrete pavement. The standard practice was to space ¾-in. transverse expansion joints from 75 to 125 ft. apart and dummy joints at intervals of 15 to 25 ft. Dummy joints, extending one-fourth the depth of the slab, were sealed with a suitable filler. The development of these provisions for "controlled cracking" made the use of reinforcing steel less imperative than did former practice.

All concrete pavement was cured for a period of seven days by one of several approved methods. The Army Engineers in the South Atlantic Division considered water curing to be the most satisfactory in practically all cases and recommended using cotton mats and water whenever available. These mats were kept continuously wet for the duration of the curing period. Membraneous curing compounds also were used for curing the concrete.

To assist in this large program of airfield construction, engineering personnel was secured from the various state highway departments, the American Road Builders Association, the Highway Research Board, aeronautical bureaus of some of the states the Civil Aeronautic Administration and other engineering organizations.

Two articles giving more details of methods of flexible pavement construction developed by the Army Engineers are to be published in the near future—EDITOR.

Truck Size and Weight Limits Approved by Highway Officials

Uniform standards governing the maximum dimensions, weights and speeds of motor vehicles, proposed by the Highway Transport Committee of the American Association of State Highway Officials, have been adopted by a letter ballot of the member state highway departments, with a recommendation that they be incorporated in the motor vehicle laws of all states.

Announcement of the approval of these standards has been made in the form of an official release by the Public Roads Administration, indicating that they have the endorsement of the PRA, which participated in the study.

The AASHO recommends that the standards be considered for adoption by all states in order to promote efficiency in the interstate operation of motor vehicles, increase the safety of highway transportation and establish a basis for regulation of the many relationships between the dimensions and weights of motor vehicles and the strengths and capacities of existing highways.

The standards, based upon years of research by state highway departments and the Public Roads Administration, are advocated in lieu of recommendations previously made by the association on Nov. 17, 1932, and the modified recommendations applicable during the war emergency period, which were adopted May 27, 1942.

They were submitted to representatives of the American Automobile Association, the Automobile Manufacturers Association, the National Council of Private Motor Truck Owners, Inc., the National Association of Motor Bus Operators, the American Trucking Associations, Inc., and the Trucks Trailer Manufacturers Association for review and counter-proposals before they were presented to the state highway departments for approval.

The recommendations, as finally adopted, are as follows:

1. **Width**—No vehicle, unladen or with load, shall have a total outside width in excess of 96 in. (Note: It is recognized that certain conditions inherent in the design of vehicles suggest the desirability of 102 in. as a standard maximum of width, but the existence of numerous bridges and a large mileage of highways too narrow for the safe accommodation of vehicles of such width precludes the present adoption of the higher standard of width. The state highway departments and the Public Roads Administration are urged to give serious consideration to the desirability of eventual provision for the accommodation of vehicles 102 in. in width in planning the reconstruction of federal-aid and state highways.)

2. **Height**—No vehicle, unladen or with load, shall exceed a height of 12 ft., 6 in.

3. **Length**—(a) No single truck, unladen or with load, shall have an overall length, inclusive of front and rear bumpers, in excess of 35 ft.

(b) No single bus, unladen or with load, shall have an overall length, inclusive of front and rear bumpers, in excess of 40 ft., provided that a bus in excess of 35 ft. in overall length shall have not less than three axles.

(c) No combination of truck-tractor and semi-trailer, unladen or with load, shall have an overall length, inclusive of front and rear bumpers, in excess of 50 ft.

(d) No other combination of vehicles shall consist of more than two units, and no such combination of vehicles, unladen or with load, shall have an overall length, inclusive of front and rear bumpers, in excess of 60 ft.

4. **Speed**—(a) Minimum speed. No motor vehicle shall be unnecessarily driven at such slow speed as to impede or block the normal and reasonable movement of traffic. Exception to this requirement shall be

recognized when reduced speed is necessary for safe operation or when a vehicle or combination of vehicles is necessarily or in compliance with law or police direction proceeding at reduced speed.

(b) Maximum speed. No truck shall be operated at a speed greater than 45 miles per hour. Passenger vehicles may be operated at such speeds as shall be consistent at all times with safety and the proper use of roads.

(c) Vehicles equipped with solid rubber or cushion tires shall be operated at a speed not in excess of 10 mph.

5. **Permissible Loads**—(a) No axle shall carry a load in excess of 18,000 lb. (Note: An axle load shall be defined as the total load transmitted to the road by all wheels whose centers may be included between two parallel transverse, vertical planes 40 in. apart, extending across the full width of the vehicle.)

(b) No group of axles shall carry a load in pounds in excess of the value given in the accompanying table corresponding to the distance in feet between the extreme axles of the group, measured longitudinally to the nearest foot:

(c) The maximum axle and axle-group loads recommended above are subject to reasonable reduction in the discretion of the appropriate highway authorities during periods when road subgrades have been weakened by water saturation or other cause.

(d) The operation of vehicles or combinations of vehicles having dimensions or weights in excess of the maximum limits herein recommended shall be permitted only if authorized by special certificate issued by an appropriate state authority.

MAXIMUM AXLE LOADS RECOMMENDED BY THE AASHO

Distance in feet between the extremes of any group of axles	Maximum load in pounds carried on any group of axles	Distance in feet between the extremes of any group of axles	Maximum load in pounds carried on any group of axles
4	32,000	31	53,490
5	32,000	32	54,330
6	32,000	33	55,160
7	32,000	34	55,980
8	32,610	35	56,800
9	33,580	36	57,610
10	34,550	37	58,420
11	35,510	38	59,220
12	36,470	39	60,010
13	37,420	40	60,800
14	38,360	41	61,580
15	39,300	42	62,360
16	40,230	43	63,130
17	41,160	44	63,890
18	42,080	45	64,650
19	42,990	46	65,400
20	43,900	47	66,150
21	44,800	48	66,890
22	45,700	49	67,620
23	46,590	50	68,350
24	47,470	51	69,070
25	48,350	52	69,790
26	49,220	53	70,500
27	50,090	54	71,200
28	50,950	55	71,900
29	51,800	56	72,590
30	52,650	57	73,280

Discussions of developments leading up to the adoption of these standards were published in *ENR* Jan. 11, 1945, vol. p. 24 and Jan. 10, 1946, vol. p. 48.

Making Cement Finer May Decrease Durability

As part of a research program undertaken by the U. S. Public Roads Administration to determine the causes of the rapid rate of disintegration of concrete highway bridges that was being observed in western states, a survey was made during the summer of 1944 of bridges located in Wyoming, Oregon, Washington and California. In reviewing the condition of these structures with respect to age, F. H. Jackson, principal engineer of tests, U. S. Public Roads Administration, pointed out before the 30th annual convention of the National Sand and Gravel Assn. that they seemed to fall roughly into two groups: those built during the 20's and earlier, and those built subsequent to 1930.

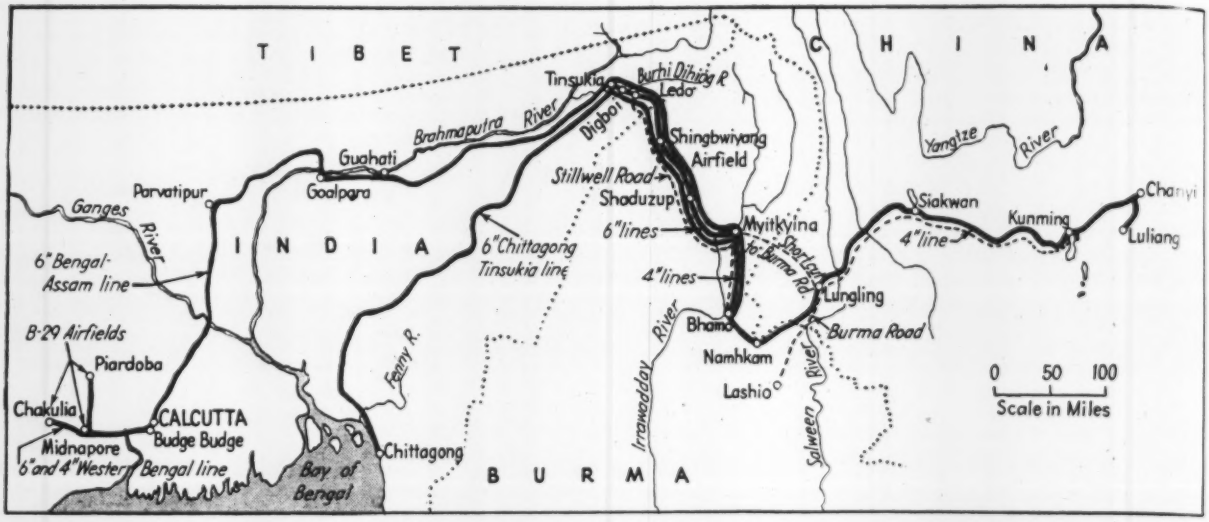
"On the whole," Mr. Jackson said, "the bridges in the first group show less disintegration than those in the second group."

Since presumably in the past 20 years there have been improvements in construction procedures, engineering supervision and methods of processing and grading aggregate, and since the general character of aggregate has not changed, modern cement is suspected of being responsible. Comparing present-day cements with the old-fashioned type, in searching for some characteristic that tends to lower resistance to weathering, Mr. Jackson finds one outstanding difference—fineness.

Recently there has been advanced a theory that may account for the supposition that modern cements do not make as durable concrete as the more coarsely ground cements used 25 years ago. According to the theory, the maximum limit of 2 percent sulphur trioxide, which has been carried for years in the A.S.T.M. specifications, while satisfactory for the coarser ground product, is not high enough for the more active, finer ground, modern cement. This applies particularly to cements high in tricalcium aluminate, since it is largely for the purpose of regulating the hydration of this particular compound that the gypsum is employed.

Recent investigations by the Portland Cement Association, Mr. Jackson said, indicate that from the standpoint of both strain and drying shrinkage, cements of high and moderately high tricalcium aluminate are improved by adding higher percentages of gypsum than are allowed by present specifications. Furthermore, even cements of low tricalcium aluminate content appear to be similarly improved when the alkali content is high.

There are also some indications that drying shrinkage may be influenced by the alkali content of the cement independently of the calcium aluminate content. The association is now engaged in an intensive study of this problem, with the idea of determining by means of laboratory freezing and thawing tests whether the use of larger quantities of gypsum will improve durability.



Network of American pipelines, totaling over 3,000 miles, through which gas and oil were transported from India to China.

Our P. O. L. Pipelines to China

***Contents in Brief** — Part of what was literally a worldwide system of transport for supplying combat forces in China, the 3,286 miles of military pipeline in the Bengal and Assam provinces of India and across North Burma to China required one of the truly great construction achievements of the war. Paralleling the Stilwell and Burma roads, where these existed, and striking out across swamps and rugged mountains otherwise, the lines were built under jungle and combat conditions that required a high order of ability and fortitude.*

PIPELINE OPERATIONS in the India-Burma and the China theaters were so successful that by war's end the Stilwell Road could be used simply as a one-way truck delivery route, the Corps of Engineers reveals in releasing additional details of the planning and construction of the world's longest military pipeline system for P.O.L. (petrol, oil, lubricants).

Pipelines paralleling the Stilwell Road, (*ENR* Feb. 1, 1945, vol. p. 150 and 151) instead of supplanting the "lift" by plane over the Hump of the Himalaya Mountains, provided enough gas and oil and unloading points to the Air Transport Command that its increased air cargo capacity made unnecessary a previously planned truck convoy operation, roundtrip. Thereafter, truck convoys hauled equipment too heavy for air transport; but the convoys went largely in one direction—to China. Cargo planes were the only carriers making the round trip.

Similarly, pipelines from Calcutta and Chittagong to Tinsukia in Assam province were completed so quickly and paid off so handsomely in tonnages delivered that a large-scale barge line contemplated for the Brahmaputra River was sharply curtailed.

By June, 1945, the pipeline system originating at ports on the Bay of Bengal had been completed to Kunming, China, and beyond, with loops to airfields around Chanyi and Luliang, as shown on the map. Other details are given in the accompanying table.

In one sense, the Ledo or Stilwell Road and the Burma Road were construction "tote" roads for the pipeline crews. Without truck access to the line-laying and pumping station crews, the army would have had to fly the pipe in by helicopter, for much of the territory crossed by the pipeline is ranked among the world's most isolated terrain.

The pipeline system was authorized at the Quebec Conference in August, 1943. The first section, moving east from the existing small refinery at Digboi in Assam province in November, 1943, shared the construction vicissitudes of the Ledo Road as well as the combat hardships of the North Burma campaign. The line supplied P.O.L. both to combat troops and roadbuilders

PIPELINES SOLD FOR SCRAP

NEW DELHI, India,—March 15, 1946—The famous India and Burma pipelines have been sold as scrap, the U. S. Foreign Liquidation Commission has announced.

The Chittagong-Tinsukia and Budge Budge-Tinsukia (Bengal-Assam) pipelines, in India, were sold for $1,271,032. They cost the U. S. $10,624,156.

The Burma pipeline, comprising two sections from Tinsukia to Myitkyina and from Tinsukia to Wanting, China, was sold for $105,919. It cost the U. S. $20,950,661.

The announcement explained the disproportion in sales price of the pipelines was due to the fact that scrap recovery on the India line was far easier than on those lines in the Burma jungles.

while it grew, and it grew as fast as the Japs were cleared out and the road extended.

Constructed of 14-ga. welded steel tubing of 4-in. and 6-in. O.D., the pipe was delivered in 20-ft. lengths. These averaged about 80 lb. per section for the smaller size, which was shipped inside the larger. The smaller pipe has a capacity of 200 bbl, and the 6-in. carries 600 bbl. Except for certain special sections of line where welded joints are required, the pipe sections were joined by flexible couplings made up of a cast two-piece collar drawn tight against a rubber gasket. Pumping stations, serviced by centrifugal or reciprocating gasoline-powered pumps, were installed at about 10-mile intervals along the line.

DETAILS OF MILITARY PIPELINES IN C.B.I. THEATRE

Location	Western Bengal	Bengal-Assam	Chittagong-Tinsukia	Tinsukia-Myitkyina	Tinsukia-Kunming	Tinsukia-Bhamo	Kunming-Chanyi-Area
Size and Length	6"-70 mi. 4"-110 mi.	6"-752 mi.	6"-570 mi.	6"-292 mi.	4"-922 mi.	4"-393 mi.	4"-177 mi.
Long Tons Monthly at 83% Load Factor	27,300	27,300	28,000	36,000	13,600	13,600	13,600
Tank Farms (Barrels)	470,000 Budge-Budge	518,000	Chittagong	220,000 Tinsukia	100,000 Kunming		
Pump Stations and Type	3 "McGregor" centrifugals	31 "McGregor" centrifugals	6 "Gould" centrifugals, 14 "Gaso" reciprocating	14 "Gaso" reciprocating	78 "Gaso" reciprocating		2 "Gaso" reciprocating
Major River Crossings	Hooghly (4 crossings)	Ganges, Brahma-putra, Burhi-Dihing	Fenny Burhi Dihing	Tarung Tanai Tawang	Tarung Tanai Tawang Irrawaddy Tayingho Salween Mekong	Tarung Tanai Tawang Irrawaddy Tayingho	

On May 13, 1944, the first aviation gasoline arrived through the Tinsukia line at the strategic airbase of Shingbwiyang. Between there and where the next air strip was under construction, a 13-mile swamp had been turned into an inland sea by the monsoon. Working mostly at night so that they would not interfere with the trucks carrying combat supplies, the Engineers took pipe from trucks moving at slow speed along a one-way causeway and walked it into position through waist-deep mud and water, under conditions so bad that their heavy duty army shoes lasted only 10 days. The pipe was coupled from boats and allowed to sink into the morass. The Engineers did not see it again until the water receded in December. Gas and diesel oil arrived at the air strip on June 10, relieving 40 percent of the truck shipments battling the causeway bottleneck.

Close behind the Japs

Within nine days after the capture of the air strip at Myitkyina on August 3, 1944, a complete Engineer petroleum distribution company had been flown in with 20 miles of pipe, which was laid northward as rapidly as tactical conditions would permit. Myitkyina fell on November 8, and on November 19 the pipeline was complete to the Myitkyina airfield. It had been laid temporarily by way of a detour through the worst of the monsoon floods. Ponton rafts and assault boats replaced tractor sleds and elephants; and in some places pipe had to be coupled into 600-ft. sections and floated into position.

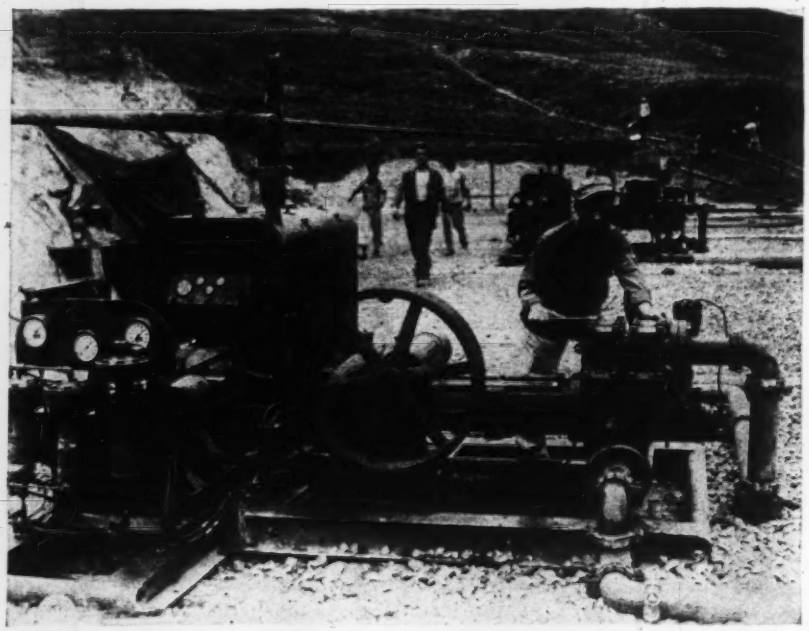
Even before the road was finished to Myitkyina, pipeline engineers, supplied by air, were pushing on toward the besieged city of Bhamo. One detachment was unloading pipe from combat cargo planes the first day the captured airport at Bhamo was in operation. Three days after Bhamo fell, pipeline gas was being dispensed to trucks, and the engineers had by-passed the town to continue the line toward China.

By October, 1944, a small group of pipeline engineers had been flown over the Hump to start work on the line back toward Burma from the China side. In some places the China section of the line had to scale 9,000-ft. elevations. Where it cut far off the Burma Road, access spur roads had to be built to work sites. In one place thousands of Chinese coolies, working with the pipeline engineers, dismantled equipment and hand-carried it eleven miles to the construction site. While the first convoy over the Stilwell Road was held at Namhkam on Jan. 25, 1945, waiting for the road to be cleared of Japanese die-hards, the Engineers were waiting also, to connect the last link in the line. When the first gas arrived

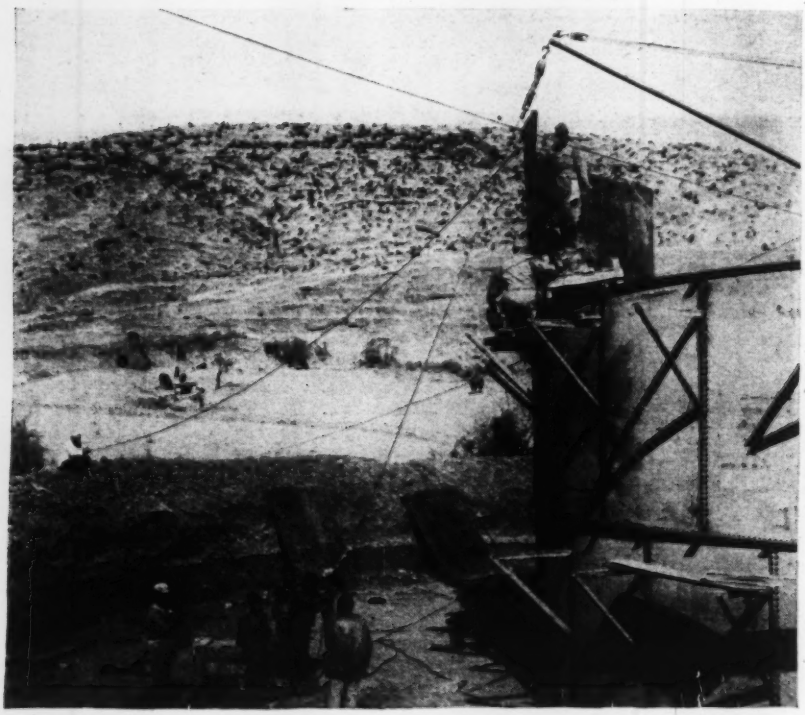
Engineer troops suspending a length of pipe from an anchored cable span.

via pipeline at a major base in China on April 9, 1945, six days had been cut from the target date set months before for the 922-mile section.

The other sections of the system were less dramatic but no less important than the Tinsukia to Kunming section. The Western Bengal section had the highest military priority, extending from the tanker berths at Budge Budge to the VLR (Very Long Range) airfields for the B-29 bombers west of Calcutta. All fields were serviced by the pipeline. The Bengal-Assam pipeline project serviced the Hump cargo lift fields in Assam, and provided bulk gasoline for cargo over the Hump to China. Its construction presented difficulties similar to the Tinsukia-Kunming line. The Ganges and the Brahmaputra had to be crossed, and during flood seasons, much of the route was under water.



One of the pumping stations, located at about 10-mile spacing along the China line.



Erecting plates for a 5,000-bbl. bolted oil storage tank at one of the tank farms.

The Chittagong-Tinsukia line supplemented the Bengal-Assam line in supplying the ever increasing demand for gasoline in the Assam area.

The Tinsukia-Myitkyina and Tinsukia-Bhamo lines were built to service airfields, road transport, and maintenance along the Stilwell Road so as not to cut into the volume of P.O.L. that could be delivered at the end of the line into China.

Supervision of the work

Construction responsibility for the various projects in the pipeline system was divided between Engineer District 12 and Advance Section 3. Engineer District 12, responsible for construction of the Western Bengal, Bengal-Assam, and Chittagong-Tinsukia lines, was under the command of Col. William C. Kinsolving, formerly general manager and general superintendent of the Sun Pipeline Co. Pipeline construction in Advance Section 3, including the Tinsukia-Myitkyina, Tinsukia-Kunming, Tinsukia-Bhamo, and the Kunming-Chanyi area projects, was under the command of Maj. Gen. Lewis A. Pick, with Col. Birney K. Morse the staff officer in charge of construction and operation of the lines. Colonel Morse was formerly chief engineer and a director of the Susquehanna Pipeline Co. Col. Edson W. Berlin was area petroleum officer for the China-Burma-India theater, having staff responsibility for pipeline planning as well as responsibility for petroleum distribution to all U. S. forces in the theater.

Since the pipelines were intimately bound up with other transport—air, rail, and water—in the overall army job of supplying combat forces in China across India and Burma, they were part of Lieut. Gen. Raymond A. Wheeler's supply responsibilities. General Wheeler, now Chief of Engineers in Washington, was ordered to activate a Service of Supply in what was then the China-Burma-India theater in March, 1942. He later became deputy Supreme Allied Commander of the South East Asia Command.

Equipment Developed for Mass Production Of Precast Concrete Houses

***Contents in Brief**—Applying the "carryall" method of earth moving to mass housing construction, R. G. LeTourneau has developed a huge rubber-tired "Tournalayer" that casts, monolithically, a four-room concrete house, lifts and carries the 58-ton load from its casting base at a central concreting plant and lowers the house onto its permanent site. Several houses have been completed by this method and others are in various stages of construction both at the company's plant near Vicksburg, Miss., and at Longview, Tex. The entire unit, which consists of a prime mover, a huge U-shaped trailer and collapsible forms are to be fabricated for rental to contractors engaged in in mass construction of houses.*

WHAT may well prove to be a boon to the national housing program is the four-room, precast concrete house developed by R. G. LeTourneau, and designed primarily for mass production. It has passed the experimental stage and 100 units are being built this year for employee occupancy at the company's plants at Vicksburg, Miss., and Longview, Tex.

The house now being built is the outgrowth of a two-year experiment with precast-concrete housing. The first was a monolithic four-room "clover-leaf" type; the second, a five-room house composed of individually constructed single rooms which were joined together in the final assembly; and the third model was a ten-sided oval-shaped "warehouse" type structure 12 ft. high and 31 ft. in diameter. By eliminating the mechanical and construction faults discovered in the three preliminary types, and combining their good points, the result is a comfortable low-cost bungalow that can be produced rapidly and in large quantities by on-site mass production methods.

Measuring 30x24 ft. out-to-out of 5-in. concrete exterior walls, the floor plan includes an 18½x11½-ft. living room, a 12½x9½-ft. combination kitchen and dinette, two 12x11½-ft. bedrooms,

Fig. 1. Four-room precast concrete houses are being erected to house LeTourneau employees of Vicksburg, Miss

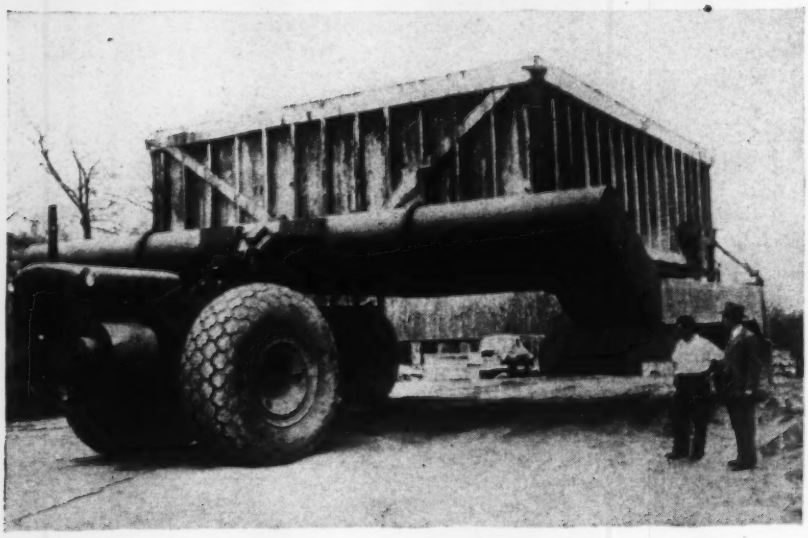


Fig. 2. After the walls and roof have been poured at the concreting plant (top), the house is picked up exposing the collapsible interior forms (center) and trundled to its prepared site (bottom).

a bathroom and a small utility room which houses the heating unit. A 5-in. concrete center wall separates the bedrooms and bath from the other two rooms.

The roof also is of concrete, 7 in. thick at the parapet and slopes to 5 in. at the center for drainage, which is carried to a cast-iron downspout at the rear. Ceiling heights are a minimum of 8 ft. Interior partitions installed to date, other than the center concrete wall, have been cinder block, plywood, or 2x4-in. timber studs faced with wall-board. Steel partition walls are planned to be used when such material becomes available.

Poured in one operation

Although the design of the house is simple, construction is most unusual. Exterior walls, center wall and roof are poured in one continuous operation at a centrally located concreting plant. Wall forms are steel plate reinforced with light steel beams. The two forms which shape the interior walls are collapsible. Outside forms, which are joined at the four corners by eccentric expansion hinges, operate in conjunction with a huge U-shaped rubber-tired, steel-frame lifting trailer, termed a Tournalayer, which carries the house from the concreting plant to the building site.

No liner is used inside the wall forms, resulting in the concrete being placed directly against the steel plates. This provides a fairly smooth finish, requiring only a small amount of rubbing with a carborundum stone after forms are removed.

Inner forms are in two sections and shape the inside walls and ceilings of the house. An eccentric cam mechanism on the inside of each inner section of inner form moves all four walls inward or outward. This is for the purpose of stripping the forms from the concrete after it has set.

After the walls and roof have been poured and permitted to harden for approximately 24 hours, the interior forms are loosened by collapsing them slightly inward at two control points. Three electrically driven hoists mounted on the Tournalayer, one at the front and one each near the rear corners, then lift the 58-ton concrete house about 9 ft. to clear the interior forms.

In this position the house, which is still attached to the exterior forms, is

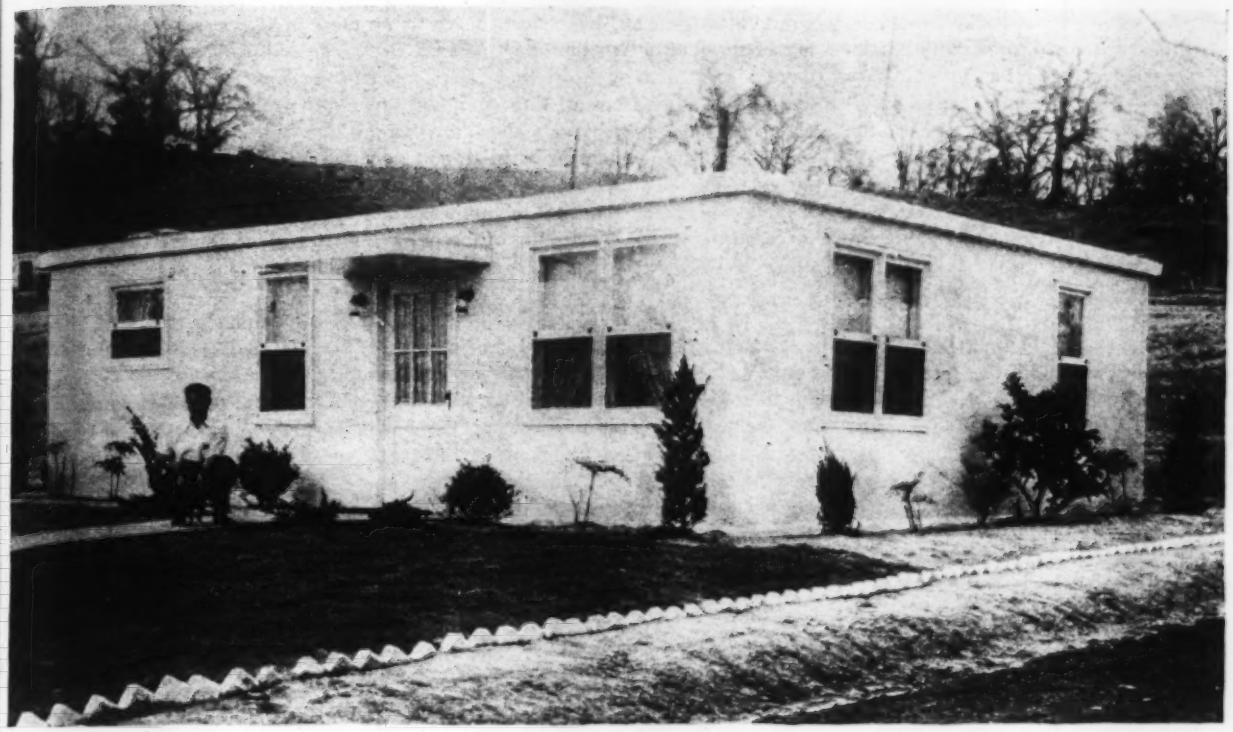


Fig. 3. Simple in design but attractive in appearance, the houses are 30 x 24 ft. out-to-out of the 5-in. concrete exterior walls. The plan provides for a living room, two bedrooms, kitchen and dinette, a bathroom, and a small utility room.

carried by the Tournalayer to its location site. There, it is lowered into position, following which the exterior forms are loosened at the four corners, raised to clear the house and trundled back to the concreting plant to start another construction cycle. Houses are cured with a water spray for two or three days after being set in final position.

Little reinforcement used

Exterior walls have no independent footings, but the bottom 12 in. of wall is flared on the outside to give a 12-in. base width in contact with the ground. Walls and roof are reinforced with a welded steel fabric at their mid-thickness the fabric being made up of $\frac{3}{8}$-in. reinforcing bars spaced 12 in. each way. Openings provided for windows and doors are reinforced with an eight-sided, welded stirrup made of a $\frac{3}{4}$-in. reinforcing bar. One $\frac{3}{4}$-in. bar also is placed horizontally in the 4-in. overhanging parapet and in the haunched portion of the exterior walls at their base. Corners are reinforced with one $\frac{3}{4}$-in. bar placed vertically inside of stirrups welded to the longitudinal bars in the parapet and at the base of the walls. All reinforcement is prefabricated on the site.

Floors are unreinforced concrete, 5 in. thick topped with a 1-in. trowel-finished layer of concrete which may contain iron oxide to give it a light reddish color. The floor is placed independently of the walls after the house has been set in final position. In one of the houses experiments have been made with radiant heating, using a gas heater and hot water circulating through about 500 ft. of 1-in. pipe buried in the concrete floor of the building.

In preparing the site of this house for installing the floor, a 6-in. insulating layer of cinders was spread inside the walls of the previously placed house. Three layers of waterproof paper were spread over the cinder blanket, on top of which was placed about a $\frac{1}{4}$-in. layer of lime to prevent chemical reaction between the heating pipes and any acid that might be contained in the cinders. The heating pipes were laid directly in the lime, and embedded in the concrete floor which was placed directly on the lime.

A test run on the efficiency of the radiant heating system last fall when the temperature outside was 18 deg. F. disclosed that for a temperature of 78 deg. at floor level inside the house, the temperature 4 ft. above the floor was 74 deg., and at the ceiling it was 77.5 deg.

Other methods of heating are also being tested. Special methods of heating will be prescribed where the heat load for a year is much greater than it is in Mississippi or Texas.

Weight carried by outer forms

When pouring a house, the inner and outer forms set directly on a level steel casting plate. Forms are held in correct position at the base by guide lugs and plates welded to this base plate. Threaded $\frac{1}{2}$-in. tie rods extending through the forms hold them in correct position, 5 in. apart. Before lifting a house preparatory to moving it to its final site, these tie rods are driven outward to disengage the inner forms. However, they are left embedded in the concrete until the outer form is stripped, since they are one of the means of transferring the weight of the house to the Tournalayer.

The concrete roof is placed directly on a $\frac{3}{8}$-in. steel-ribbed plate form supported on steel falsework inside the house. The top surface of the roof is hand screeded to the required thickness. Wall reinforcement and electri-

cal conduit are accurately positioned prior to setting the exterior forms.

All concrete is vibrated, with particular care taken to see that no voids are left adjacent to the timber bucks previously set in the walls to receive the door jambs and window frames.

Although the lifting frame, or Tournalayer, is ungainly in appearance it efficiently performs the operations for which it was designed—that of lifting, transporting and setting the house. The Tournalayer measures about 51 ft. from the nose of the 200-hp. tractor that powers it, to the rear of the lifting frame. It has an overall width of about 35 ft. and stands 13½ ft. high.

Structurally, the Tournalayer, which is currently in production at various LeTourneau plants and which will be assembled at Longview, Tex., consists of a huge electrically steerable Tournapull with trailer attached. The trailer consists of a large torsional cross-beam with the lengthwise shafts straddling the house with a wheel under the rear of each shaft.

Three electric hoists are mounted on the wagon unit. One is mounted toward the rear of the side of each shaft and one is mounted in front at the middle of the large cross beam forming a three point suspension for independent leveling of the house. On the later model, there also is a main hoist that raises the house bodily from all three points at once. The suspension cables are fastened to the outside forms in three places only. To release the wagon from the form and connect it to another form, requires only the pulling of three pins.

A 120-ton moving job

The point of lift at the front of the frame coincides with the centerline of the house and the centerline of the tractor frame. Those at the rear of the frames are about 2 ft. in front of the rear axles. Individual electric motors at each hoist, powered by a 75-kva. generator on the tractor elevate and lower the houses. Approximate weights are: Tournalayer, 15 tons; tractor, 20 tons; and the steel forms, 50 tons.

Four large tires are needed to transport the combined weight of tractor, Tournalayer, outer forms and the concrete house, estimated to be 240,000 lb. The tires used to carry this load are 8-ft. dia., 30x40-in., 34-ply and inflated to 45 psi.

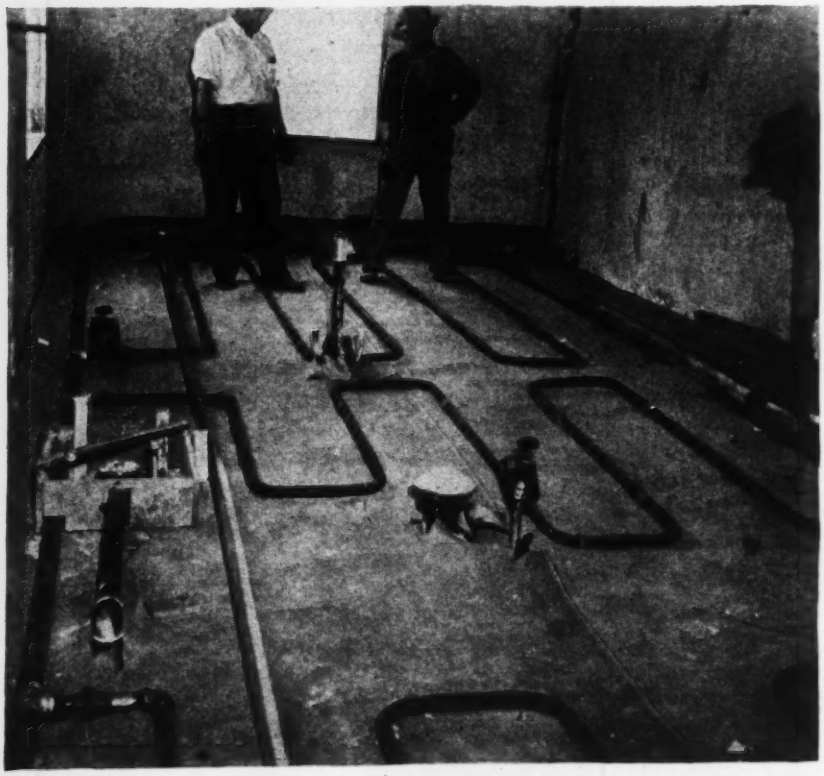


Fig. 4. In one of the houses, hot water from a gas heater furnishes radiant heat by its circulation through 500 ft. of 1-in. pipe embedded in the concrete floor.

Forms and equipment for constructing these precast concrete houses have been designed primarily for large housing projects. It is not intended to use this equipment for the construction of a few houses in partially developed residential neighborhoods. It is estimated that a well organized crew using five sets of collapsible forms, one Tournalayer, and other incidental equipment can build from 80 to 125 houses per month.

It is contemplated that with reasonably normal working conditions, the monthly machinery rental prices will be such that the use of the machinery will cost the contractors somewhere between $300 and $500 per house. As above described, this house, made of 45 cu. yd. of insulating concrete and a ton of reinforcing steel, a coat of waterproofing rubbed on the outside, decorated on the inside, doors hung and windows set, partitions, etc., but no plumbing except the electric conduit installed in the walls and ceiling, can be built for about $1,500. Completed plumbing and fixtures, heating unit and fixtures, kitchen cabinets, tile or linoleum floors on the concrete, book cases, ventilating fans, etc., probably will increase the cost of a finished house to $3,500.

No condensation has appeared to date on the interior concrete surface of the first house built, which was completed last August. This is mainly due to the use of absorbent concrete produced by using regular or expanded slag. LeTourneau engineers are working on special insulating aggregates for colder climates. Exterior surfaces of the walls are waterproofed with a white cement-base waterproofing paint. All interior wall surfaces and the ceiling are painted with a commercial interior paint.

According to present plans, R. G. LeTourneau does not plan to build the houses commercially, but will fabricate the equipment which will be supplied to contractors and real estate firms on a rental basis.

Component parts of the Tournalayer, as well as auxiliary equipment including a radically new 7-cu. yd. concrete mixer, and a Tournacrane needed for lifting heavy forms and equipment, will be fabricated at the LeTourneau factories at Peoria, Ill., Vicksburg, Miss., Toccoa, Ga., and Longview, Tex. Marketing headquarters are located at their Longview plant.

Beginning A Section On...

CURRENT WATERWORKS DEVELOPMENT

FEATURED IN THIS SECTION

Unit Construction of a Filter Plant 97
Tapping a Wet Well Under Pressure 101
Lobster Inspired Design of Flexible Pipe Joint 104
Increasing Flow Through a Gravity Tunnel 106
Cement Joints for Cast-Iron Water Lines 108
A Multiple-Purpose Seal Coat for Waterworks 110
Water District Makes Its Own Zeolite 114
Fluted Central Column Featured in Tank Design 116

Unit Construction of a Filter Plant

***Contents in Brief**—Scheduled for completion early this fall, the filtration plant at the Bluff Creek Reservoir near Oklahoma City, Okla., will furnish that city an additional 15 mgd. of filtered water. Incorporating latest features of contemporary design, the new plant is laid out to permit future enlargement with a minimum of new construction. Of singular interest are the low-lift pumping arrangements to accommodate a 40-ft. variation in lake level, push-button control for water sampling and safety signals for equipment operation.*

FUNCTIONAL DESIGN and provisions for future enlargement, rather than architectural treatment are the paramount features of the water filtration plant now under construction just below the Bluff Creek Reservoir about eight miles northwest of Oklahoma City, Okla. Ultimately the plant will contain four 15-mgd. units for a total capacity of 60 mgd. Envisaging the need for progressive enlargement, designs were made to construct the first 15-mgd. unit now, add a second unit when necessary and develop the plant to its ultimate capacity by adding two more units at some future date.

To permit doubling its present capacity of 15 mgd. with a minimum of expense, the first unit, which was started last May and is expected to be completed and placed in operation by fall, contains the following features.

A 6x7-ft. reinforced concrete conduit connecting the intake tower inside the reservoir to the low-lift pump station and capable of handling 60 mgd. Installed facilities that will accommodate the treatment of 30 mgd. include 2,100 lin. ft. of 48-in. cast iron raw-water line from the low-lift pump station to the filter plant, a chemical building, a 150,000-gal. structural steel washwater tank and a high-lift pump station to contain one 10-mgd. and two 5-mgd. pumps, with provisions for adding a 10-mgd. unit when needed. A 48-in. cast iron high-pressure distribution main from the filter plant to the city already was installed.

Planned for increased capacity

Units of the new plant that will require duplication to increase its capacity to 30 mgd. include the low-lift pump station with one 10-mgd. pump and one 5-mgd. pump; a flocculator and a detention basin, each 99x35x14 ft.; a 100-ft. dia. clarifier having a 13-ft. 9-in. side-water depth; and extension of the present filter building to house four additional 3½-mgd. filter basins.

In addition to the present 6x7-ft. conduit beneath the dam, connections have been provided where feasible for enlarging the plant from 30 to 60 mgd. This expansion, which will be virtually a duplication of the 30 mgd. layout, is not expected to be required by the growth of the city's water demands for several years.

A brief resume of the functional design of the plant is of interest since it embodies several improvements in filter plant layout. Starting at the reservoir, an electric fish screen is installed at the intake of the concrete conduit. Connections also are provided in the raw-water line for the future addition of a chain-type fish screen, if needed.

Due to the extreme fluctuations of the water level in the Bluff Creek Reservoir the low-lift pumps have a wide range of duty. When full, the top 10 ft. of the 100-ft. deep reservoir will flow by gravity to the filter plant. Yet the anticipated draw-down of the reservoir will subject the pumps to a positive head of 3 ft., when the reservoir is down 13 ft., and to a maximum head of 40 ft. at the lowest practical water level.

To meet this unusually wide variation in head the 10-mgd. centrifugal pump is powered by a 40-hp., single-speed motor for low head and a two-speed motor capable of producing

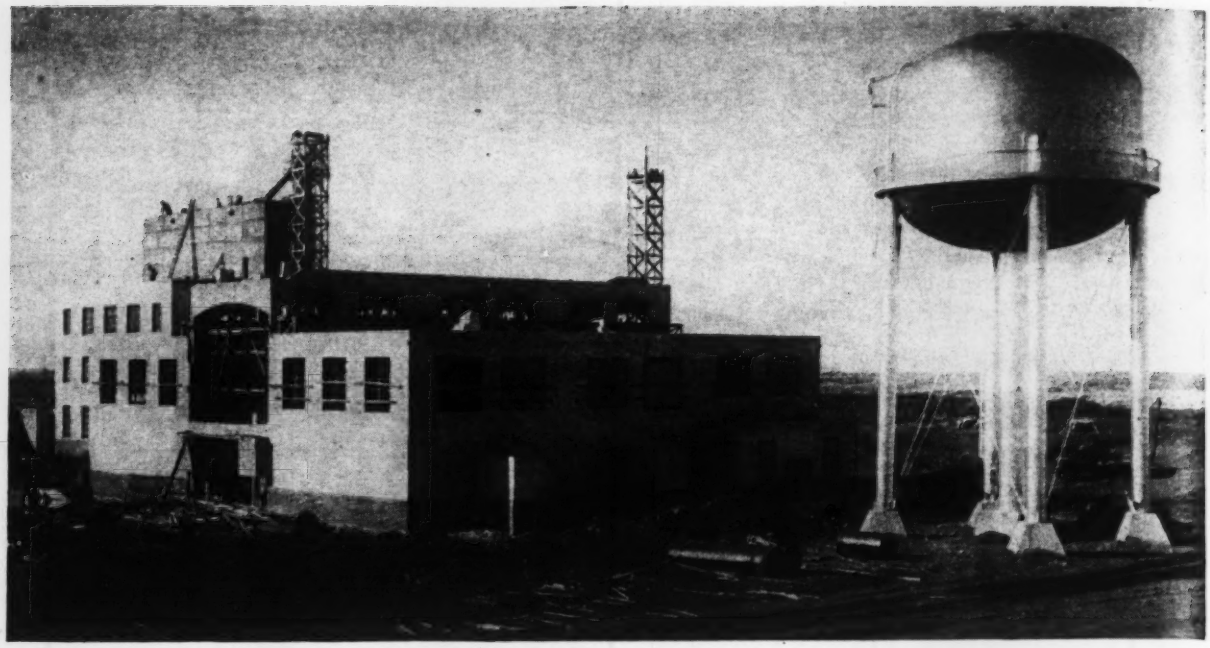


Fig. 1. When completed this fall, Oklahoma City's new water filtration plant will have a rated capacity of 15 mgd.

either 70 or 100 hp. for a high head of pressure. Similarly the 5-mgd. centrifugal pump has a 15-hp. single-speed motor and a 50-32 hp. two-speed motor. In each case the two motors are connected to the pump by flexible couplings.

Each of the small motors operates at constant speed throughout its range. When the head becomes too high, the flexible coupling of the small motor is disconnected by hand and the coupling of the large motor is connected to the pump shaft. The large motor then carries the load up to its maximum specified head of 40 ft. All motors are 440-v., 60-cycle, 3 phase.

Prechlorination of the raw water is performed at a point about 1,000 ft. from the outlet end of the raw-water line by remote control from the main operating room in the chemical building. This permits complete mixing of the chlorine and water before it reaches the flash mixer.

The automatic control, solution-feed chlorinator for prechlorination has two ranges of capacity; one from 350 to 2,000 lb. per day, the other from 75 to 450 lb. per day. The chlorine room will be equipped with an indicating raw-water flow meter which will permit the operator to adjust the chlorine rate of feed to the amount of water being treated without leaving the chlorine room.

In addition to both prechlorination and postchlorination, the water is treated with lime and soda ash for softening, with lime being used to excess, and alum for coagulation. A part of the sludge from the clarifier also is returned to the raw-water line ahead of the flash mixer. Normally, the hardness of the water averages from 10 to 12 grains per gallon, which amount is expected to be reduced to about 5 when the plant begins operation. The treated water also is recarbonated ahead of the filters.

Underwater recarbonator

Postchlorination will be provided by a manually controlled solution-feed chlorinator having a range from 40 to 240 lb. per day. The one-ton chlorine cylinders when in use will be mounted on platform scales equipped with an indicating and recording meter to record continuously the loss of weight of chlorine withdrawn from the containers. The scales are equipped with an alarm to signal when a chlorine cylinder is emptied.

Ventilating fans, operated from outside the chlorine feed and storage rooms, are large enough to empty each room in five minutes in an emergency. Rubber-lined steel pipe will carry the chlorine solution to points of injection, where diffusers will disperse the solution evenly in the water.

Chemicals are added by gravity flow from the chemical feeders to the raw water in a temporary 6-ft. square open manhole just ahead of the flash mixer. A master mixing basin will be installed when the plant's present capacity is increased to 30 mgd. to avoid split-mixing of chemicals, which is apt to occur if two separate manholes are used.

Following approximately 80 sec. of flash mixing the treated water flows into the flocculator basin which is designed for a 30-min. detention period at a 15-mgd. capacity. The flocculator is equipped with six rows of paddles, three paddle wheels to each row, operated by a dry-well system drive mounted outside the basin. Since the local lime used in treating the water contains a considerable quantity of unburned particles, four collector sumps are installed at the intake end of the flocculator basin. This excess lime is collected in the sumps and discharged by gravity through an 8-in. line into the wash-water sewer.

From the flocculator the treated water flows by gravity into the 100-ft. dia. reinforced concrete clarifier, where it is detained 80 min., and then flows into the detention basin, which is the same size as the flocculator basin and separated from it by a dividing wall. A 30-min. detention period is provided here to kill any dysentery germs or amoeba not destroyed in the clarifier and in the event that the treated water has a high pH value due to the excessive use of lime.

Upon leaving the detention basin the treated water passes to the recarbonator, which is of the submerged combustion type having a capacity of 5,000 lb. of CO_2 per 24 hr. and adjustable within a range of 40 to 100 percent capacity. The recarbonator is of the full automatic pH control type, activated by the pH instrument on the filter influent. Manual operation also is provided at the unit.

The four filter basins are 24 ft. wide, 37 ft. long and 10 ft. deep. Containing 888 sq. ft. of filter area, each basin will have a 3¾-mgd. capacity at a filtration rate of 3 gal. per sq. ft. per minute. When stepped up to 4 gal. per sq. ft., each basin can produce 5 mgd. of filtered water. Filter basins are equipped with rotary surface washers.

Wash-water troughs are of ¼-in. sheet steel stiffened with light angles near the top. Underdrain laterals are 3-in. cast iron pipe spaced 12 in. apart with $\frac{7}{16}$-in. orifices at 6 in. c. to c. Threaded brass ferrules were screwed into tapped holes in the pipe to form the orifices. Wagner type drain blocks were installed between the cast iron pipes.

Character of filter media

Anthrafilt, having an effective size of 0.70 mm. and a uniformity coefficient not less than 1.70 was used for the top 27 in. of filter media. The usual top layer of fine gravel was replaced with No. 2 ($\frac{3}{32}$ to $\frac{3}{16}$-in.) anthrafilt to a depth of 3 in. Beneath this was placed 4 in. of $\frac{3}{16}$ to ½-in. gravel, 4 in. of ½ to 1-in. gravel and 5½ in. of gravel varying in gradation from 1 to 1½ in. This, together with the 4½-in. deep Wagner blocks, provides 48 in. of filter media. A ¾-mg. clear-water reservoir is provided under the high-lift pump station located in the filter building.

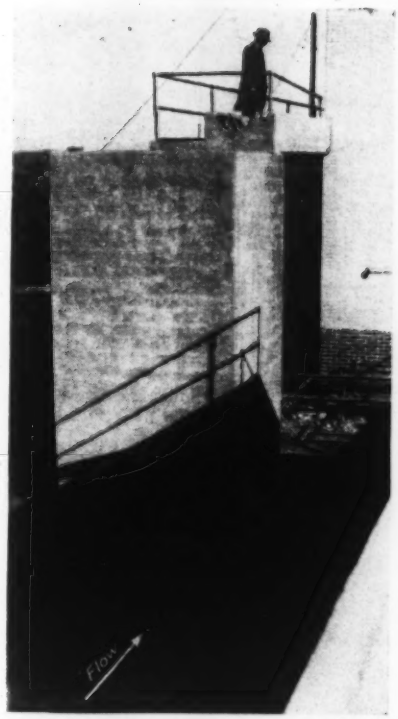


Fig. 2. Chemicals are added to the raw water in a 6-ft. sq. concrete manhole just ahead of the flash mixer.

All piping in the filter gallery and exposed piping from the high-lift pumps will be moisture proofed with an asphalt paint. While the paint is still moist, ground cork of maximum size will be sprinkled over the entire surface. After the paint has dried, the surface will be sprayed with paint to match the surrounding color of the plant.

One singular innovation of the new plant is the assembly-line sampling for making water tests at six different points throughout the plant: (1) in the raw-water line before prechlorination, (2) the chlorinated water ahead of the intake manhole, (3) following flocculation, (4) after coming from the clarifier, (5) just ahead of the filters and (6) following filtration and ahead of the clear-water well to see how much postchlorination will be needed. Push-button control at the laboratory sink provides instant access to samples of water drawn from these six control points through small copper tubes under pressure from a 5-gpm. electric pump.

Washwater sludge lagoon

Another feature of the plant is a small earthfill dam constructed nearby to form a settling basin for the used wash water. After this water has settled it is pumped back into the manhole ahead of the flash mixer and treated the same as water from the main reservoir. It is estimated that this sludge lagoon, which will have a storage capacity of about 110-acre-ft., will become filled with sediment in five years, at which time the city may construct a lime-reclaiming plant.

The chemical and filter buildings are of reinforced concrete construction, with brick exterior and tile interior trim. Chemical feed machines include two for alum, two lime feeders and slakers, one soda ash machine with provisions for another to be added when needed, and a sodium hexametaphosphate feeder. Bucket elevators and

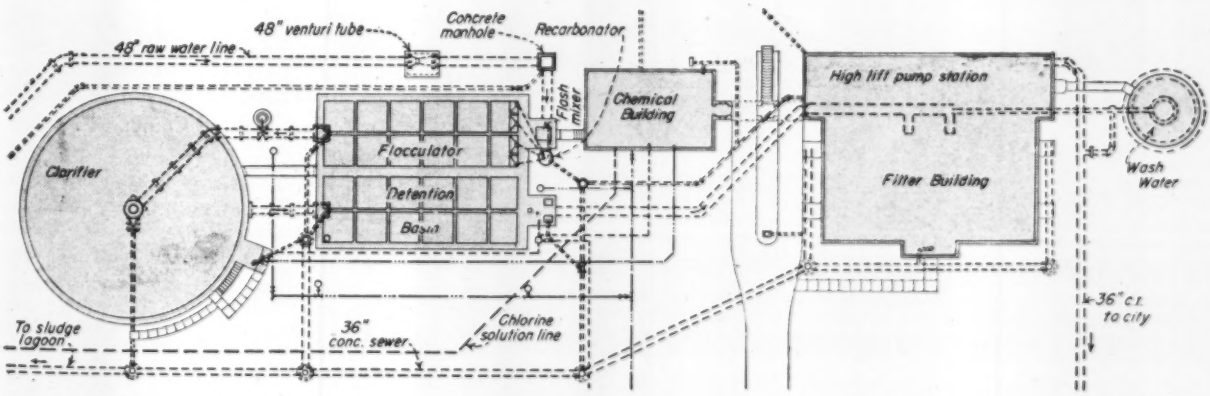


Fig. 3. By duplicating the present clarifier, flocculator and detention basins, lengthening the filter building and installing four additional filter basins, the plant's capacity can be increased to 30 mgd.

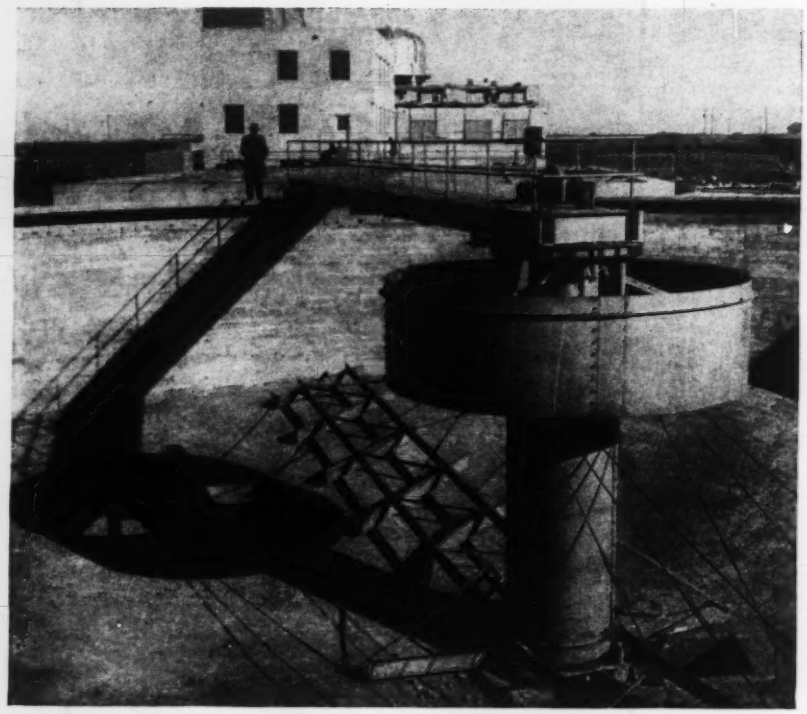


Fig. 4. Following 80 sec. of flash mixing and 30 min. of flocculation, the treated water is detained 80 min. in a 100-ft. dia. reinforced concrete clarifier.

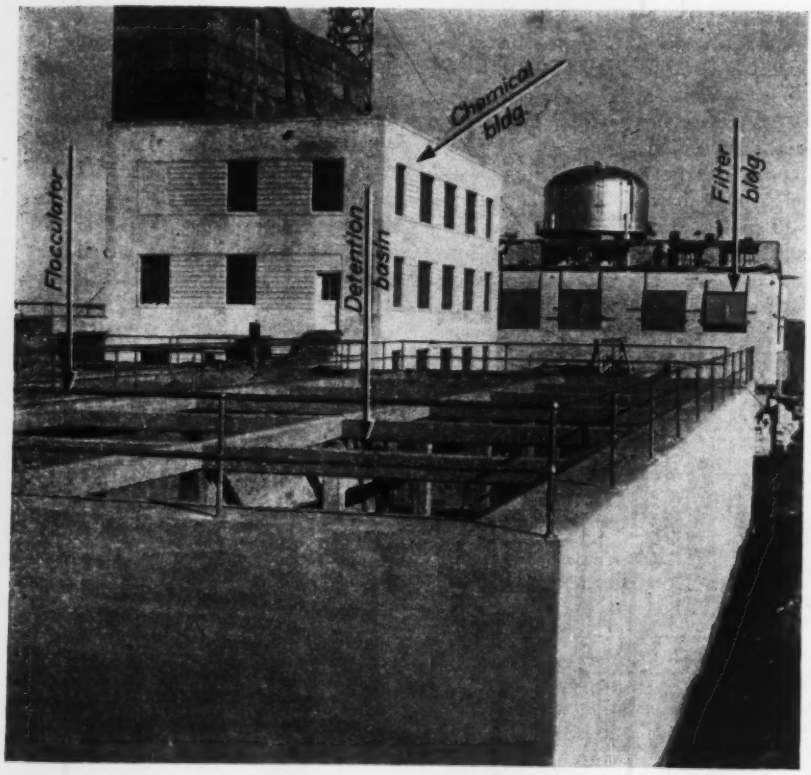


Fig. 5. Treated water from the clarifier is detained 30 min. in a reinforced concrete detention basin before passing to the filters.

screw conveyors deposit the dry chemical in 100-ton bins located above the chemical feeders.

Of unusual interest is the extensive alarm system installed to indicate failure of any one of 22 pieces of operating equipment. By simultaneously sounding a Klaxon and flashing a red light this mechanism gives warning of a breakdown of the low-lift and high-lift pumps, the chlorine feeders, return wash water and sludge pumps, the flash mixers, flocculator, clarifier, wash-water pump, and the recarbonating machine. In case of a temporary shutdown the low-lift and high-lift pumps can be started by remote control from the control room in the chemical building, but the operator must go to the other units to start them, which is an added precaution for safety.

Bluff Creek Reservoir

Completion of this first unit of the new filtration plant marks the culmination of Oklahoma City's long-range plans to increase its water supply. For the past 35 years the city has been served by Lake Overhosler located on the North Canadian River about nine miles due west of the city.

But this supply, about 17,000 acre-ft., proved inadequate as the city grew in population; construction of the Bluff Creek Reservoir, located on a tributary of the Cimarron River, naturally followed. Water for storage in the new reservoir is diverted from the North Canadian River at a point near Lake Overholser through a large open-cut canal through the divide separating the two watersheds.

Construction of the four-mile long earth dam forming the Bluff Creek Reservoir, together with the five-mile open canal and 3,000 ft. of reinforced concrete inverted siphon, was started in September 1941 (*ENR* May 7, 1942, vol. p. 788); first water was diverted into the reservoir in April 1944.

V. V. Long and Company, consulting engineers of Oklahoma City, prepared the designs for the new filtration plant and are supervising its construction. Kenneth Klaffke is chief draftsman and J. M. Richards, project engineer. The Harmon Construction Co., Oklahoma City, holds a $1,032,000 contract for constructing the plant; Glenn Callarman is superintendent of construction. Ralph Lee is city engineer and M. B. Cunningham is superintendent of the Water Department.

Tapping a Wet Well Under Pressure

By using a tremie-placed concrete seal held in correct position with a steel lifting frame, Chicago recently tapped a large wet well in one of its pumping stations without interrupting service. The high velocity and hydrostatic pressure within the well required elaborate preparations and careful construction. A canvas bag was used as a form for the seal.

ONE of the most intricate problems encountered in increasing the capacity of an existing water pumping plant is that of connecting the suction tunnel for the new pump with the existing wet well. The well must be kept in continuous service to supply other pumps in the plant, thus preventing its being shut down long enough to permit drilling the tunnel through the wall of the well.

That such an operation can be performed successfully, however, has been demonstrated for the third time in Chicago when a 5-ft. dia. suction tunnel recently was "cut in" to the large wet well at the Springfield Avenue pumping station, without disturbing the normal operations of the plant. Similar connections have been made in previous years at the Central Park and at the Springfield Avenue pumping stations.

Tremie concrete seal

The method employed by Chicago involved pouring a tremie concrete seal within a canvas bag against the inside of the wall of the well at the intake end of the suction tunnel. This seal, which was reinforced with a structural steel frame, withstood the hydrostatic pressure inside the well while the tunnel was drilled through the wall. The seal then was removed from the well.

Although the concrete-seal method of tapping a wet well is not new, methods employed by Chicago are worthy of note since they are applicable to the enlargement of smaller pumping plants. Excavating and concreting the suction shaft and tunnel, preparatory to tapping the well was a simple job of rock excavation, except that no blasting was permitted due to the proximity of two other tunnels.

All excavation was in Niagara limestone, using pneumatic drills and concrete breakers. The muck was hoisted by hand onto the floor of the plant, shoveled into a bucket and elevated by the plant's overhead crane into a dump car operating on a narrow gage track cantilevered a short distance inside the building at balcony level. From this point the muck was carried to a spoil pile outside of the building, loaded by clamshell into trucks and hauled away.

The suction shaft, over which an 80-mgd. steam-turbine driven centrifugal pump is to be installed this year, is located in one corner of the pump

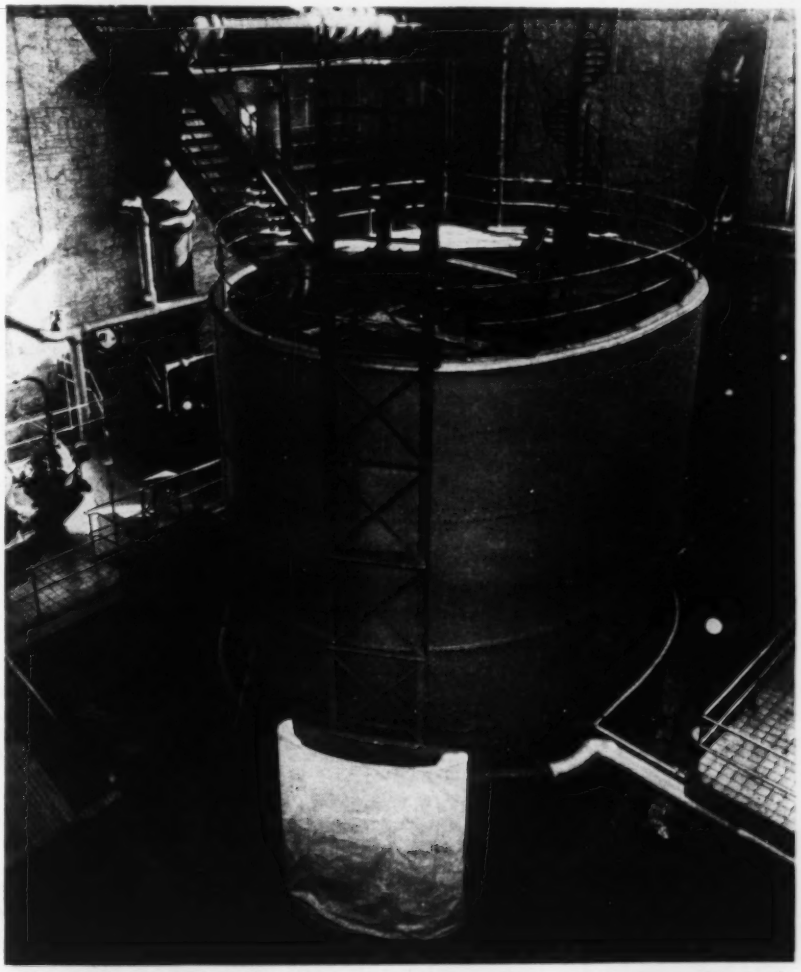


Fig. 1. Concrete tremied into a canvas bag attached to a steel lifting frame placed inside of the wet well at the Springfield Avenue pumping plant in Chicago facilitated the "cutting in" of an additional suction tunnel for a new pump to be installed.

room about 29 ft. from the wall of the wet well. This new pump will provide additional pumpage for residential and industrial consumption in the northwest part of the city. The suction shaft, 6 ft. in dia. was drilled through the 3½-ft. concrete floor of the plant and 14½ ft. into the underlying rock. The 5-ft. dia. suction tunnel was drilled from the bottom of the shaft to the wall of the well. Bores for the shaft and tunnel were made 8 ft. and 7 ft. in dia., respectively, and lined with 12 in. of unreinforced concrete.

A large cast iron suction casting, tapered from 5 ft. 3 in. dia. at the bottom to 3½ ft. at the top was concreted in place at the top of the shaft to support the centrifugal pump. Top of casting is 6 in. above floor level of the pump room.

While the tunnel excavation was going forward preparations were being made to install the concrete seal. Some idea of the magnitude of the job can be gained from a brief description of existing facilities in the pumping field.

The wet well, located in the center of the pump room, stands 26 ft. above the floor of the room and extends 17 ft. below, coinciding with the bottom of the new suction tunnel. The well, which is encased in steel plate down to rock is elliptical, measuring 30x20 ft., inside of a 12-in. brick lining wall. It is fed by a 10-ft. intake tunnel and, in turn, serves one 80-mgd. and three 60-mgd. steam driven centrifugal pumps in addition to the new pump to be installed this year.

This large pumpage, together with the fact that under normal operations there is a 25-ft. water depth in the well, precluded the possibility of employing divers to aid in installing the concrete seal. Consequently, all work connected with making the seal had to be carried on from the top of the well, which is covered with steel plate supported on structural beams.

Bottom anchored with long drills

In theory, installing the concrete seal was simple. It consisted of mounting a bag made of 12-oz. canvas at the bottom of a 35-ft. high structural steel frame. The frame and bag were picked up by the overhead crane and placed inside the well, with the bag adjacent to the inside surface of the wall at the location of the end of the suction tunnel. The frame was anchored at the bottom by long drills, extending 6 in. into the concrete floor of the well. The top of the frame was held in position by steel struts bearing against the wet well screen located about 34 ft. above the bottom of the well.

When everything was in readiness the bag was filled with tremied concrete through a 6-in. by 40-ft. pipe extending down from the top of the well. The bottom of the pipe was fitted with a wooden plug and rubber gasket. Water pressure was applied to the outside of the tremie pipe to hold the plug in position while the assembly was lowered in the well. The plug then was forced out of the end of the pipe ahead of the grout, and it floated to the surface for removal.

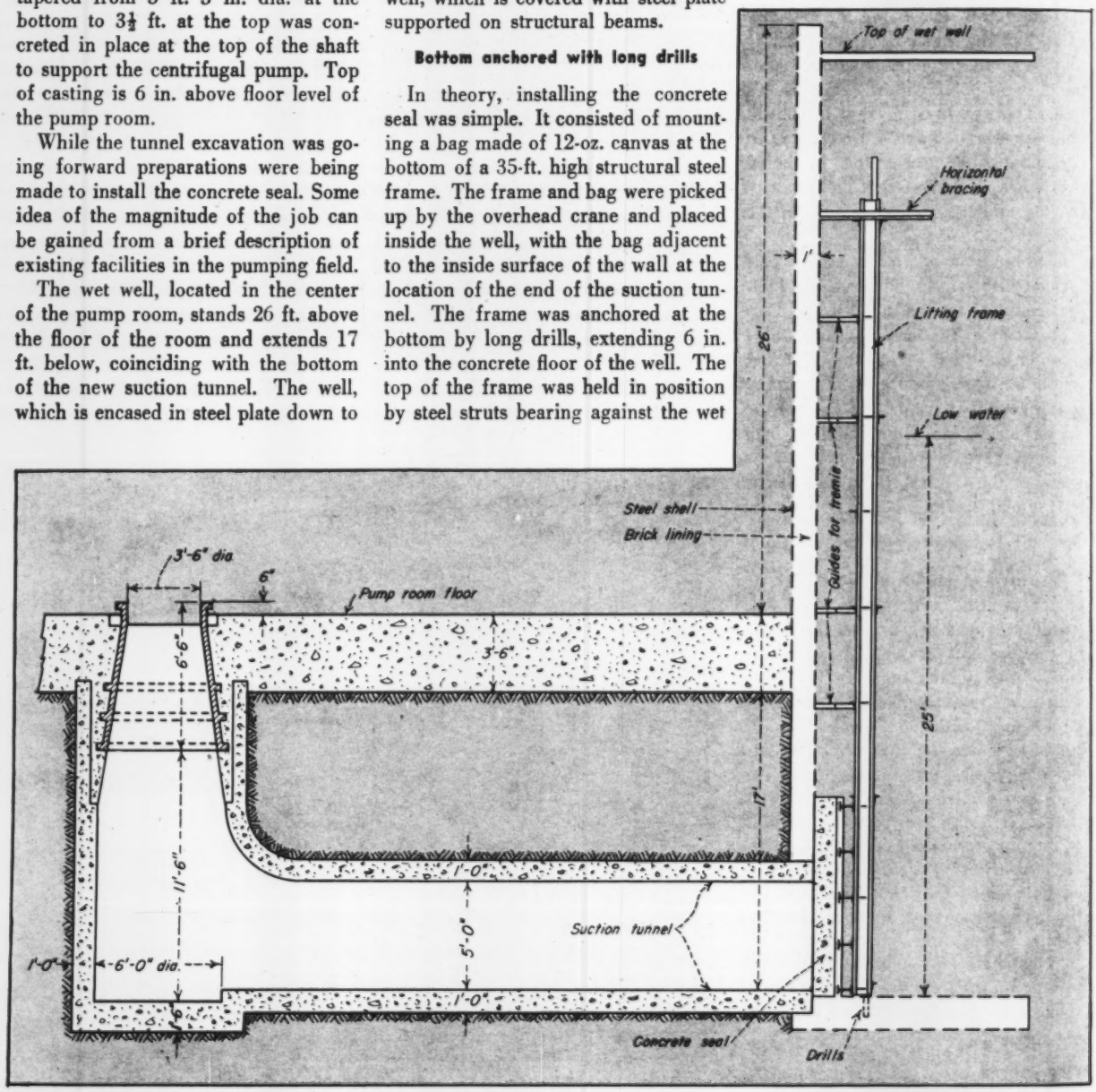


Fig. 2. Upon completion of the suction shaft and tunnel in solid rock for the new pump, the wet well was tapped by cutting out a circular section of the brick wall of the well into the tremied concrete seal.

After the seal had hardened and the suction tunnel had been cut through the wall of the well, the water pressure was equalized on both sides of the seal and the steel frame and bag of concrete were lifted out of the well.

Seal poured in canvas bag

The structural arrangement of the steel frame and details of the canvas bag are of interest since therein lies the secret of a successful performance of the job. The bag, which contained about 3 cu. yd. of cement grout was left open at the top. In reality, it consisted of a layer of canvas stretched across 2x$\frac{1}{8}$-in. steel straps located at the top, bottom and center of the bag, and curved to the inside radius of the well. The sides and bottom of the canvas were tacked to 2x4-in. pine boards bolted to the 8$\frac{1}{2}$x9-ft. reinforcing frame. The rear of the bag was a $\frac{5}{16}$-in. steel web plate welded to 10-in. steel beams placed horizontally and bearing on two vertical 8-in. beams forming the lifting frame.

Hooked bolts, welded to the web plate, became embedded in the tremied concrete and prevented its coming loose from the steel frame. Steel strips welded to the front flanges of vertical beams guided the tremie pipe but allowed it to be raised during removal.

Anchoring the bottom of the frame required careful preparation since it had to be located properly to insure good bearing of the seal against the interior face of the wall. Also, drilling of the anchors had to be done from the top of the well.

The vertical frame, consisting of two 8-in., 17-lb. beams spaced 4 ft. apart and cross-braced with angles and bars, was fabricated 35 ft. long, extending about 7 ft. above the normal water level inside the well. This gave a 7-ft. leverage for adjusting the bottom of the frame into correct position. The bent straps for holding the tremie pipe in place also served as guides to keep the frame away from the wall.

The bottom anchorage for the critical frame was made with four 1$\frac{3}{4}$-in. drills, 38 ft. long, operating in four 2-in. extra heavy pipe guides welded to the inside faces of the rear flanges of the 8-in. vertical beams. After drilling 6 in. into the floor of the well, the drills were left in place to serve as anchor bolts. After the well was tapped they were removed along with the frame and the seal.

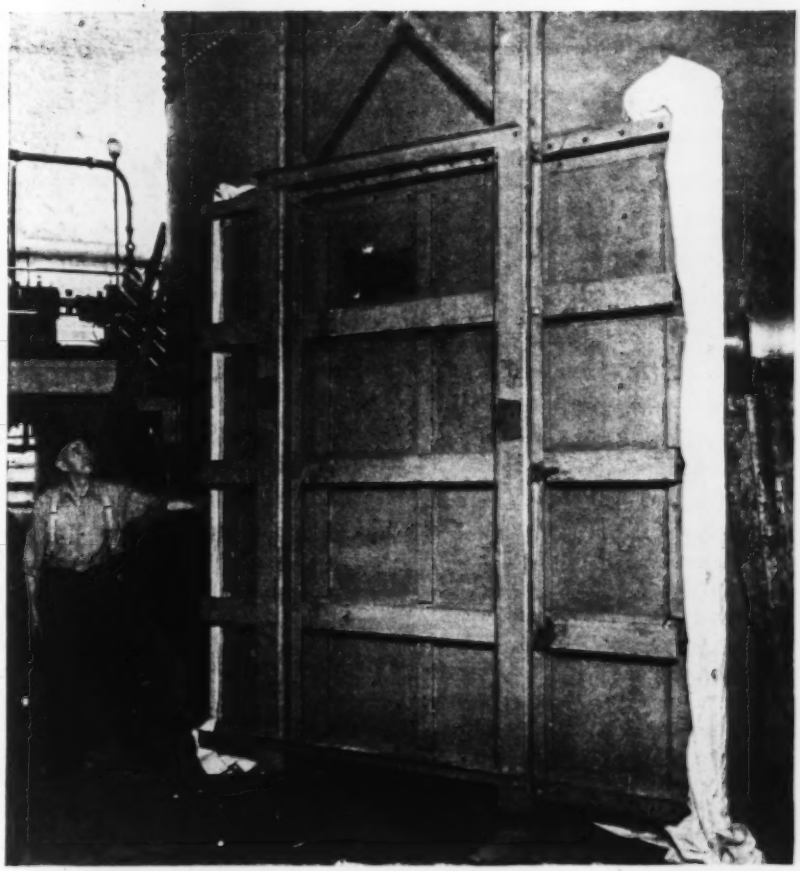


Fig. 3. Measuring 9 ft. high, 8½ ft. wide and about 12 in. thick, the concrete seal was placed inside a canvas bag tacked to timbers which were bolted to a steel frame welded to vertical beams for installing and removing the seal. The strength of the seal is in the steel beams and web plate.

All field work in connection with increasing the capacity of the Springfield Avenue pumping station is being done with city forces under the Bureau of Engineering. W. B. Rich is resident engineer in charge of the work under the supervision of John S. Dean, engineer of waterworks construction, both reporting to W. W. DeBerard, city engineer.

More Water Softening Installations

During the war some 135 municipal water softening plants were installed, according to H. M. Olson, The Ohio Salt Co., who stated at a recent meeting of the American Chemical Society that the total number of plants in operation at the beginning of this year was 710. About 35 percent of the plants employ the zeolite process.

Mr. Olson also reported that experimental tests on the control of scale and corrosion in hot water at temperatures of 185 to 200 deg. F. were made by the Army Corps of Engineers, with fine results. Also, most mobile hospitals were provided with zeolite units to furnish soft water.

Cold-water vacuum deaeration as practiced in industry before the war was given added impetus in many plants. And the electrolytic cell type of water softening developed during the war may, in Mr. Olson's opinion, reach a state of development where it would offer keen competition to other types of water softening.

Softening of water with individual household units continues to gain in popularity, said Mr. Olson, and as of January, 1946, some 130,000 units were installed in more than 750 communities.

Design of First Flexible Pipe Joint Resulted from Study of Lobster's Tail

M. N. Baker
Associate Editor, Engineering News-Record (Retired)

***Contents in Brief**—A water main laid beneath the River Clyde at Glasgow, Scotland, in 1810, was the first pipe to be provided with flexible joints. The designer, James Watt, got his idea for the joints from a study of the abdominal articulation of the lobster. The following article tells how the pipeline came into being, gives details of its design, and describes methods used for assembling, launching and sinking it into a trench dredged in the river bottom.*

No PRECEDENT for a flexible joint in submerged water mains existed when the original pipeline under the River Clyde at Glasgow, Scotland, was designed in 1810. But pumps driven by the steam engines of James Watt were already delivering water into reservoirs and dwellings above its point of origin and it was believed that the problem could be solved by Watt's inventive genius, coupled with the manufacturing ability of Boulton, Watt & Co. and the availability of cast-iron pipe in large sizes. This faith, thanks to the invention and use of the Watt flexible joint, was justified. Since then, hundreds of submerged pipelines using flexible joints based on Watt's adaptation of the tail joints of the lobster have been installed all over the world.

Various schemes for supplying water to Glasgow were projected from the early sixteenth century onward. Yet, late in the eighteenth century only limited areas of the city were served by water piped to street "standpipes" and a few houses; it was not until 1807 that the Glasgow Water Works Co. began a city-wide service of water pumped from the River Clyde.

First filter galleries

The works, designed by Thomas Telford, included the first filter in the world intended to serve an entire city with treated water piped into houses—as contrasted with filtered water carted to consumers a little earlier at the near-by city of Paisley and also at Paris. But the Glasgow filters were a failure. Meanwhile, a rival water company had begun to supply the city and, although its supply was not filtered at the start, the competition cut the revenue of the Glasgow Water Works Co.

Confronted with the failure of Telford's filter and the competition of its rival, the company decided to go across the river to a peninsula composed of sand and gravel where it seemed probable that a large quantity of water, either filtered through the sand bed from the river or from natural springs, might be obtained by sinking wells and connecting them by tunnels. Tests showed that the scheme promised success, and tunneling was begun in 1809.

Thus originated what became known as "filter galleries", built for a few waterworks in Scotland and England, more extensively in France and, in the last half of the nineteenth century, at a goodly number of waterworks in the United States.

Fig. 1. Flexible joints in the abdomen of a lobster gave James Watt the basic idea for his design of the first flexible-jointed submarine water main.

Confronted by the problem of bringing a large quantity of water from across the navigable Clyde, the water company applied for aid to Boulton, Watt & Co., who had supplied it with pumping engines.

Altogether, four plans for getting water across the Clyde were considered by the water company. One proposal was to pump the water to a height above the flood mark and carry it across the river in a trough laid at that level. Another was to lay nine lead pipes, about 5 in. in diameter, across the bed of the river. By their pliability these pipes would adapt themselves to the irregularities of the river bed.

A third party suggested that a tunnel be driven under the river; but the substrata were found to be sand and running mud, consequently the scheme was impracticable.

The fourth plan, suggested by Watt, proposed the use of cast-iron pipe 15 in. in diameter, fitted where necessary with revolving joints, such as are now known as ball and socket joints and which Watt invented for the purpose.

Joint resembles lobster's tail

It was necessary to fit the pipes to the uneven and shifting bed of the river. Watt, on turning over the subject in his mind, shortly hit upon a plan. Taking the tail of a lobster as his model, he devised a tube of iron, similarly articulated, of which Boulton & Watt sent drawings to the waterworks company.

With the drawings was sent a description of the method to be employed in putting the pipeline together on shore, launching it and sinking it in

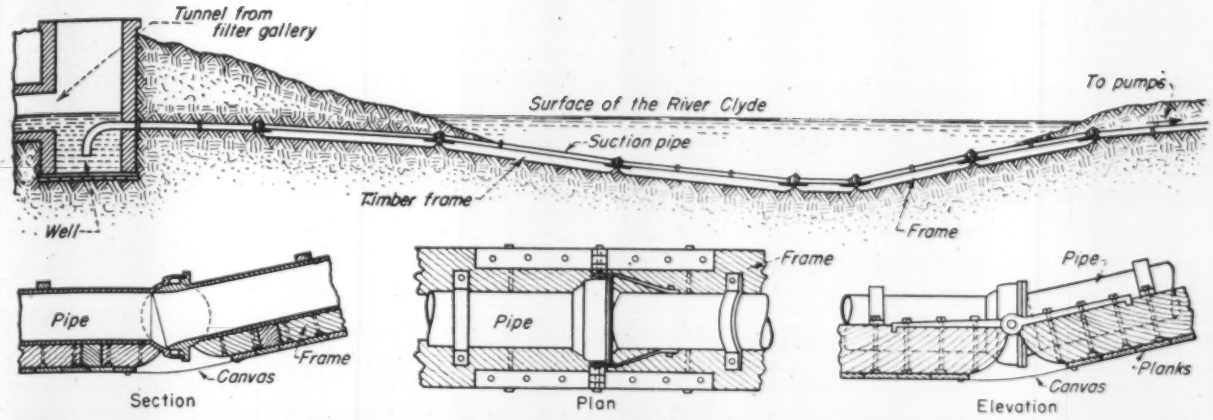


Fig. 2. Profile and joint details, copied from Boulton & Watt's original drawing, show how the first Glasgow water main under the River Clyde was provided with the flexibility needed to meet irregularities of the river bed. Note how the joints resemble those of the lobster, permitting motion only in a vertical plane.

a dredged channel. Acting upon their recommendation, the company had the main installed with complete success. Watt declined to be paid for the essential service thus rendered.

Boulton & Watt's design of the Glasgow flexible joint is shown in Fig. 2. The view of a lobster (Fig. 1) shows the acumen of the designer of the joint in adapting nature's ways to an engineering problem. This is made clearer when it is known that the lobster's abdomen is made up of a series of ring-like segments united to each other by flexible membranes, so that the segments are movable one upon the other in a vertical plane. Thus, the whole abdomen can be bent forward under the body or straightened out behind, but not bent sideways, because there is a hinge at each side formed by a peg-like process of one segment fitting into a socket in the next segment. While each joint between segments therefore allows only a small amount of bending, all the joints acting together allow considerable movement.

Details of Watt's plan

Worthy of presentation both as a bold pioneer engineering adventure of a century and a quarter ago and as an outline of the project itself, are the following excerpts from the description by Boulton, Watt & Co. of its design for the Glasgow flexible-jointed submerged pipe and of the method for hauling the pipeline across the Clyde and lowering it into a prepared channel in the bed of the river.

"... pipe to be 15 Inches inside Diameter, Inch thick and 9 feet long each, exclusive of the joints, ... should possess some degree of flexibility to accommodate themselves to the irregularities of the bottom; for if they were rigid it would scarcely be possible to avoid breaking them, or the pipes, in laying them down. This we propose to effect by making every second joint a portion of a sphere, and the intermediate ones spiggot or slip joints ... The founder who makes the pipes should be directed to make the globular parts of the joints zones of a true sphere, whose center is that of the pipe to which it belongs, otherwise they will not act properly in all positions. These joints ... are to be packed with a soft rope thoroughly soaked in a warm mixture of tallow and whiting.

Pipes supported on frames

To hold the pipes together and to give them a firm bed in the River, they are proposed to be fixed upon Frames made of two parallel logs of timber; each frame, except that which lies in the deepest water, carrying two or three pipes ... Each of these frames is joined to the next by means of strong hinges of cast iron, and care must be taken that the axes of these pairs of hinges be in a line with the axis of the globular joint to which they correspond ...

Previous to laying the pipes, a strong row of piles should be driven across the river in a straight line, at about 12 feet distances; their tops should stand some feet above the water and are to be joined by a rail made of split balk or spars, at the water's edge, or a little higher: their horizontal distance from the center line of the intended bed of the pipes should be half the breadth of a Pont boat, their use being to guide a Pont in a straight line in laying the pipes. A channel or groove must then be formed across the river by dredging ... This groove or channel should be at least 4 Yards wide, lest the river should carry sand into it while you are preparing other necessary operations. During the time you are dredging out this channel in the river a similar one should be continued upwards, by hand labour in the land on the South side ... it being there that we propose the pipes and frames to be put together previous to launching them ...

... The end of the Suction pipe is to be plugged up so as also to be watertight; the object of which is, that the weight of the pipes may be diminished by the buoyancy of the Air contained in them ...

... To save time in the operation, it will be advisable to place the frames ready in the background, so that they may be drawn forward as they are wanted without any delay; for there is some danger that the river during the operations may in a certain degree sand up the channel, or perhaps fix the foremost frame (should they remain stationary any time) so fast that there will be difficulty in moving them again ... the whole would be drawn across in a few hours and all danger of their being set fast avoided. Some planks laid on the dry sand of the river bank for the frames to slide upon would ease their motion.

The frames and pipes being now adjusted in their proper situation in the bed of the River, ... the groove or channel in which the pipes lie may be filled up ... But, it will be proper previously to drive a row of small piles six or more feet into the bottom of the rier, close to the framing, and to cut them off a little above the level of the top side of the pipes, that in case of any undermining by the river they may keep the frame in its place ...".

Reservoir head used for cleaning

Recognizing that sand and gravel might accumulate in the long underwater suction pipe, Watt went on to describe a blowoff and gate arrangement whereby the line could be backwashed by utilizing the head of water already stored in the distribution reservoir.

In a paper describing the work and dated 1843, it is stated that the "filtering tunnels" were extended in 1818, 1826 and 1829. Later, after the Glasgow Water Works Co. absorbed its rival, the Carlton Hill Water Works Co., the consolidated works were bought by the City of Glasgow and used until 1859, when it introduced a gravity supply of high quality from Loch Katrine.

Unique Propeller Pump Installation Increases Flow In Gravity Water Tunnel

Dewey M. Radcliffe

Chief, Washington Aqueduct Operation, U. S. Engineer Office, Washington, D. C.

***Contents in Brief**—Greatly increased capacity was obtained from an existing water supply tunnel at Washington, D. C., by installation of a variable-pitch propeller-type booster pump. The unit is designed for high efficiency with a wide range in head and an output of 0 to 150 mgd. Considered the first of its type in this country, the installation is believed to offer advantages for other municipalities obtaining their water supplies through intake tunnels.*

DURING the emergency period just ended, the water supply system of Washington, D. C., was uprated from 155 to 200 mgd. by installation of a booster pump in the outlet shaft of a 9-ft. dia. tunnel 4 mi. long. This project is considered to be the first of its type in this country and is believed to offer advantages to certain other cities obtaining their water supplies through intake tunnels.

In the process of increasing the output of the Washington system, it was found that the tunnel, which conveys water under the city, created a serious bottleneck and that only by increasing the flow through this structure could greater quantities of water be processed. Under gravity flow conditions, it was possible to obtain a discharge of only 75 mgd. Much greater flows were required in order to obtain full benefit of existing filters.

Extensive flow studies of the tunnel, including salt velocity tests, were made and constituted the basis of the data shown on the accompanying discharge diagram (Fig. 1). The chart shows the tunnel capacity with various drawdown levels of the McMillan reservoir. It was not physically possible to lower the water level of the reservoir in the amounts indicated because of loss of storage capacity arrangements. Therefore, booster pumping through the tunnel was the only solution to obtain the required greater flows.

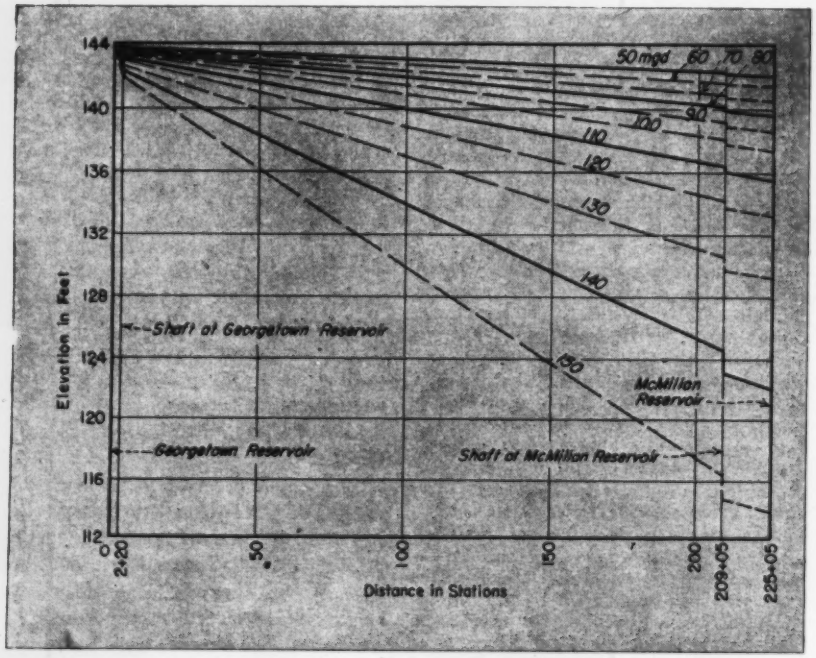


Fig. 1. Hydraulic grade for various flows between Georgetown and McMillan reservoirs. Since a drawdown sufficient to obtain the larger flows was not possible, pumping was required.

Selection of most suitable unit

Selection of the pumping equipment posed a major problem due to the wide variation in working heads and capacities which had to be met. When minimum pumping is required, the head is low; conversely, with maximum pumping demands, the head is large. Centrifugal and propeller-type pumps with variable-speed and two-speed motors were considered, but were ruled out due to installation difficulties and operation charges. The variable-pitch propeller type unit offered high efficiency over the wide pumping range required (Fig. 4) and proved to be the lowest in installation cost.

The pump finally selected is designed to deliver from 10 to 150 mgd. against a total head of 0 to 30 ft. To drive the unit at a constant speed of 327 rpm., a 1,000-hp. low-starting-torque motor designed for a 2,300-volt, 3-phase, 60-cycle power supply was selected (Fig. 5). The low starting torque, which is possible because of adjustment of the propeller blades to a minimum pitch during starting, permitted the use of a standard design motor. The entire thrust load, mechanical and water, is carried by the spring-type thrust bearing mounted on the top of the motor as in the case of hydraulic turbo-generators.

The pump was installed in the 12-ft. dia. vertical outlet shaft of the tunnel, thus eliminating a costly pumping station structure (Fig. 2). The pump is mounted in a 4-ft. thick concrete "plug." The space below the plug forms the suction chamber of the pump and the well created above the plug serves as the discharge bay, the suction bell being embedded in the plug and the pump section being bolted directly to the suction bell. Straightening vanes are provided in the discharge section.

The pump is located off center of the riser shaft so that a combination access opening, bypass, and surge relief could be provided. This 4-ft. dia. opening is equipped with a heavy hinged steel cover. Both the concrete plug and the bypass cover are designed to withstand a downward water load of 60 ft., which is expected to be the highest head that will obtain under maximum pumping and surge conditions. When the pump is in operation the cover is closed, but when no pumping is required the cover is lifted and the opening serves as a bypass for gravity flow. Waterways provided through the pump and bypass are sufficient to pass 65 mgd. with a 1-ft. loss of head. The pumping unit is not operated when the demand is below 65 mgd.

Control of the pump

Capacity of the pump is varied by changing the angle of the adjustable blades of the propeller. The blades are rotated by a crosshead mounted in the propeller hub and powered by an hydraulically operated piston immediately under the motor. The piston, which is actuated by a control located above the motor, is connected to the crosshead by a shaft operating inside the hollow main drive shaft. Oil for piston is supplied at a pressure of 125 psi. by a motor-driven accumulator.

Operation of the pump is semi-automatic. In starting and operating the unit the blade angle setting is regulated by the blade control of the head. An actuating motor providing either local or remote operation is connected to the blade control. An indicator, showing position of the blades, is located on the head and a synchronous electrical transmitter is connected to the indicator to provide remote blade-angle indication. The electrical control for overall operation is also arranged for either local or remote control—the remote station is located in the McMillan pumping plant, 1,500 ft. from the tunnel shaft. A transfer switch places the control in the desired station.

Good performance obtained

The booster pump has been in continuous service since May, 1945. Operation during that period has been entirely satisfactory. Experience at Washington would indicate that booster pumping serves to provide additional system capacity quickly at relatively low first cost and moderate operating costs. It has also demon-

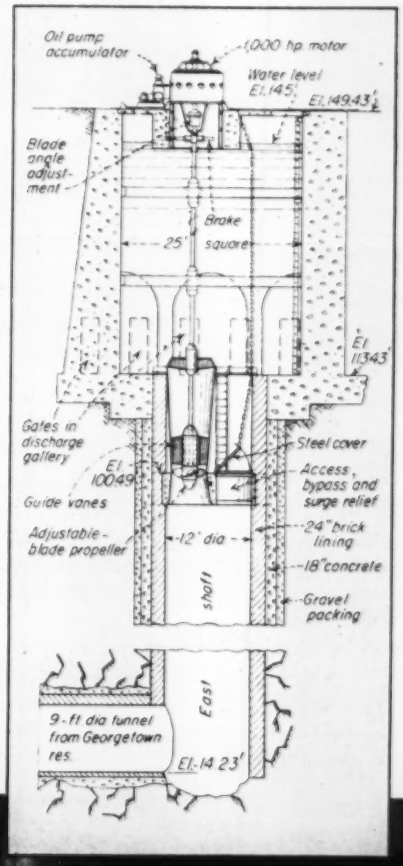


Fig. 3. The concrete plug supporting the pump is located about 45 ft. below the water level in the shaft and approximately 115 ft. above the invert of the tunnel.

Fig. 2. Flow through a 4-mi. tunnel was greatly increased by installation of 150-mgd. booster pump in the 12-ft. dia. down stream shaft of the tunnel, the pump being supported by a 4-ft. thick concrete "plug." At the left is a 4-ft. dia. bypass with a steel cover.

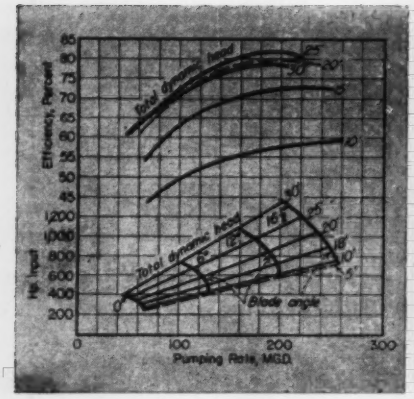


Fig. 4. Characteristics of the vertical adjustable blade pump selected. The high efficiency for a big range in both head and capacity may be noted.

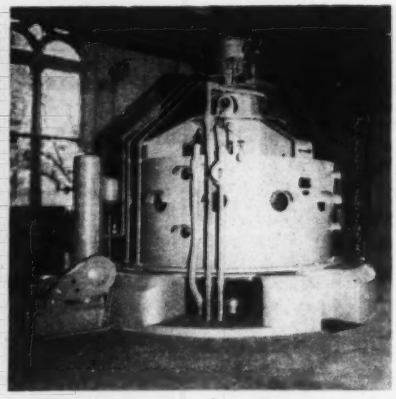


Fig. 5. Set directly over the shaft is this 1,000-hp. synchronous motor that drives the variable-pitch propeller-type pump located 50 ft. below in the shaft.

strated that booster pumping in tunnels or conduits can be employed to good advantage to increase capacity up to the point where annual pumping and carrying costs for the pump installation approach annual carrying charges on a new and equivalent gravity-flow structure.

The construction work was carried out by the Washington, D. C., office of the U. S. Army Engineers, for which Col. D. G. White is district engineer, Edwin A. Schmitt, head engineer, and the writer, chief of operations. The S. Morgan Smith Co., York, Pa., designed and built the pump.

Cement Joints Minimize Leakage In Cast-Iron Water Lines

K. F. Hoefle
Superintendent, Dallas City Waterworks
Dallas, Tex.

DALLAS has had such success with portland-cement joints in its cast-iron water mains that no other material has been used since cement was adopted for jointing purposes in 1941 following extensive tests.

One test consisted of joining a string about 200 ft. long of 6-in. dia. cast-iron pipe on top of the ground. After the joints had cured, the pipe was filled and held at a pressure of 100 psi. while a crane picked it up in the middle, raising the pipe 2 ft., the ends still resting on the ground. Then the ends were picked up about the same distance, and the filled line was moved about and thrown out of line. No joints failed and no leakage occurred.

HYDROSTATIC TESTS ON CEMENT-JOINTED PIPE
Dallas City Waterworks, Dallas, Tex.
Test of 4-hr. duration at 150-psi. pressure

Date	Pipe dia., in.	Length, ft.	Permissible leakage, gal.	Measured leakage, gal.
Nov. 13, '44	20	4,619	145.8	13.0
Nov. 15, '44	16	1,354	34.2	4.5
Nov. 25, '44	16	1,080	27.27	8.25
Dec. 20, '44	16	3,518	88.8	30.0
Jan. 8, '45	16	5,887	148.6	64.6
Feb. 6, '45	12	835	15.8	12.5
Mar. 6, '46	8	3,202	40.34	7.5
Mar. 13, '46	8	3,320	41.83	4.0

As a result of these tests, the cement joint was adopted in August 1941. No other joint has been used since.

How the joint is made

Joint material is prepared as follows: Neat, screened portland cement is thoroughly moistened to such consistency that when a handful is squeezed the mass will remain in a lump in the hand, but when dropped 6 in. will shatter (not spatter). The cement is prepared in small amounts, as it is needed.

After a joint has been yarned, the bell is filled with cement and is then calked hard with a wide curved calking tool. The filling process has to be repeated four or five times, each time calking up hard. On the last calking the cement drives as hard as lead.

While making the joint, a piece of canvas is spread on the trench bottom under the joint to catch the large amount of material which drops out of the bell. These droppings may be scooped up and used again.

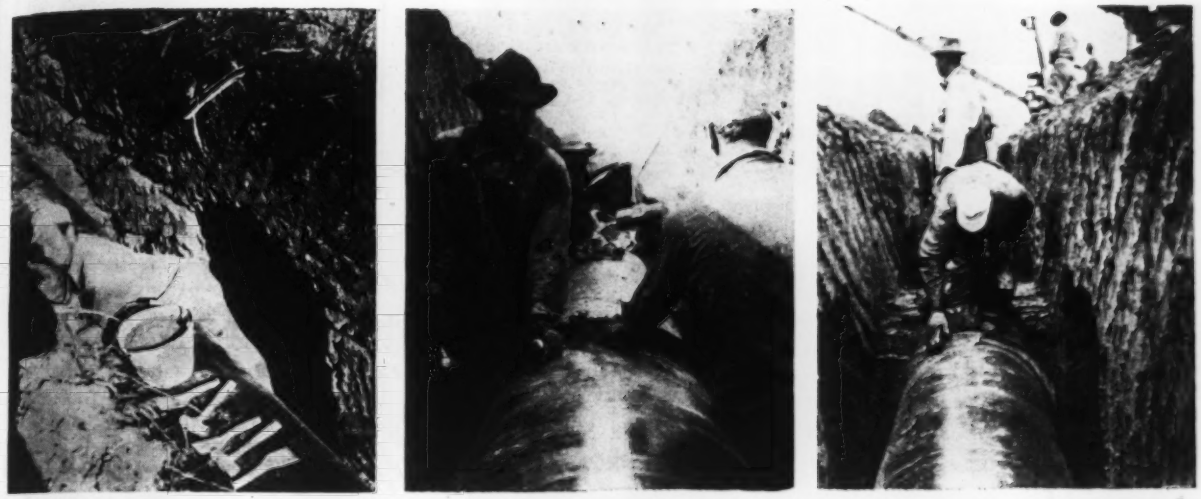
When the bell is completely filled and calked, a fillet of plastic clay is applied to the front of the bell to protect the cement. If the joint has been carefully made, the pipe may be filled at once. It is important, however, that the trench be kept free of water until the cement has taken initial set.

It has been found to be the best practice to turn water into the line as soon as possible after joints have been made. Where the run between valves is long, it is important that the cement joint be kept damp and cool by means of an ample clay fillet and by backfilling at least a foot above the top of the pipe.

Favorable results

To date, Dallas has laid 97 miles of mains in sizes from 4 to 36 in. with cement joints. Results have been uniformly excellent. No single joint has failed or developed leakage requiring corrective work. No pipe failure has occurred in any line joined with cement. It has been found that there is some initial leakage but that it automatically disappears within a few days. Therefore, the line is allowed to stand under pressure for as much as a week, if possible, before applying the test.

The present specification requires that the line when maintained under 150 psi. for 4 hr. shall show a measured leakage not in excess of 50 gal.



Calking irons used in making cement joints are wide curved tools which drive cement into bell of pipe. Center: Repeated fillings are necessary in making cement joint. Here joint calkers are driving final filling of cement into a pipe bell. Right: Plastic clay fillet is daubed over freshly made cement joint to keep it damp. Water is turned into line as soon as possible.

per inch of diameter per mile per 24 hr. (An accompanying table shows the results of eight tests made within the last 18 months). Most tests result in less than half this rate of loss, and it is thought that a specified limit of 25 gal. would not be too severe.

Cement makes such a good joint that, on the few occasions when a line has failed to pass the initial test, the trouble usually has been found at only one joint, and most commonly at the top or bottom where calkers working on opposite sides of large pipe have failed to calk to the center.

Corrosive Action of Soils On Underground Pipelines

Replacement of underground pipelines made unserviceable because of corrosive action of soils has been estimated to cost $200,000,000 a year in the United States alone, according to a recent announcement by the National Bureau of Standards, U. S. Department of Commerce.

To help minimize this great economic loss the bureau has carried on a continuous investigation over a period of 25 years. The results of this investigation are presented in a new publication — Circular C450 — prepared by Hirk H. Logan, head of the Underground Corrosion Section.

Soil characteristics and conditions are so complex that it has been found impossible to correlate corrosion with any single soil property. Likewise, no one pipe material or protective coating is the best under all soil conditions.

The bureau's studies indicate that ferrous materials in common use do not differ greatly in resistance to corrosion. However, ferrous alloys containing rather high percentages of nickel and chromium are definitely superior.

Copper and alloys with a high copper content corrode much less and more uniformly than ferrous materials. On the other hand, lead is resistant to many soils but pits deeply in some others.

Effectiveness of metallic coatings

Corrosion decreases with time and any "corrosion rate" is applicable only to the area of the pipe that was actually tested and to the period in which the measurements were made. For this reason the life of a pipe cannot be predicted from loss in weight or depth of a pit as measured during only one period.

It has been found that the effectiveness of metallic coatings depends on the soils to which they are exposed. No one coating was found to be suitable for all soils. Bituminous coatings greatly retard loss of metal, their effectiveness being roughly proportional to their thickness. Unfortunately, very few of these coatings are free from pinholes and other imperfections.

"In this connection," the bureau states, "important causes of failure are improper application and injuries received while laying the pipe. Better tools and methods have reduced the failures from these causes, but it is still difficult to secure a completely protected pipe. Even after the pipe is in place the coating may be injured by soil stress and by the roots of trees, shrubs and grass."

Results of tests on a number of promising coatings developed in the laboratory are presented in the publication. Several procedures for testing soils and coatings also are described and corrosion prevention methods compared.

Cathodic protection is shown to retard or prevent corrosion under most soil conditions and methods for applying this type of protection are briefly described.

Six appendices give details of test methods and apparatus referred to in the text of the publication.

Copies of Circular C450 may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at $1.25 each.

Multi-Purpose Seal Coat Protects Waterworks Structures

Paul Weir

Assistant General Manager, Atlanta Waterworks, Atlanta, Ga.

***Contents in Brief**—An investigation carried on in connection with rehabilitation of two large filter plants at Atlanta, Ga., led to use of a compound which served both as rustproofing and waterproofing. Applied by plant personnel and requiring very little capital outlay, the seal coat proved instrumental in restoring the deteriorated steel tanks and concrete units to service in record time. Subsequently, the material was used in repairing large cracks in concrete filter walls, as well as in waterproofing a 5-mg. concrete-lined reservoir and rustproofing cast iron valves and fittings.*

IN THE WATER SUPPLY field it is generally recognized that millions of dollars are lost each year through metal deterioration and that all metal used in contact with water should be protected. It is becoming increasingly evident, however, that deterioration of concrete should be regarded in the same light and that concrete structures in contact with water should be afforded the same protection as that given metal. As the science of water purification has progressively developed to its present efficient state higher chemical dosages are being used, or will be used. This condition may justify the engineer in specifying that all metal and concrete used in this field be properly protected at the time of construction.

Low-cost one-material application

Rustproofing of metal surfaces and waterproofing of concrete surfaces, both old and new, can be readily accomplished by a relatively inexpensive one-material application. This is borne out by experience at the Atlanta waterworks, where an investigation of various types of rustproofing and waterproofing materials resulted in use of one material as a protective coating on steel, cast iron and concrete surfaces.

The investigation was inaugurated some five years ago because of a problem of renovating and protecting two large filter plants during a period when industry was at peak production and essential material was unobtainable. One of these plants was a 50-yr. old, 18-mgd. steel-tank pressure plant; the other, a 20-yr. old, 21-mgd. reinforced concrete gravity plant.

Both of these plants were restored to their original condition in record time, largely due to the use of one product that served equally as well in waterproofing as in rustproofing. The monetary saving was great, since the program did not call for extensive capital expenditure and the work was performed by plant personnel.

Fig. 1. Flame-cleaning of old steel units was found to require two passes, in contrast to single-pass technique recommended for new steel.

In the pressure filter plant there are 36 steel-tank filters rated at 0.5 mgd. each and having a combined metal surface area of 50,000 sq. ft. These tanks, each of 8-ft. dia., 20 ft. long and holding 7,000 gal., had become so badly tuberculated on the inside (Fig. 2, left) that inherent shearing off of rust increased the iron content of the water and lowered the bacteriological efficiency of the filters to a detrimental condition.

In the gravity filter plant the 7 reinforced concrete, rapid sand units, each rated at 3 mgd. and holding 106,000 gal., had become so badly cavitated and cracked that it was difficult to keep them operating and clean. In addition, seepage loss from these units, which are 28 ft. wide, 42 ft. long and 12 ft. deep, had become increasingly evident.

What a good seal coat should do

Our research and experience indicated that a suitable rustproofing and waterproofing material should: (1) Form an intimate and lasting bond with both steel and concrete; (2) Protect against chemical and mechanical action (properties of rust inhibition and water repellancy); (3) Impart no taste or odor to the water; (4) Be tough and resilient; (5) Not become brittle with age; (6) Not cold flow; (7) Have high dielectric strength; (8) Give off no offensive or harmful fumes. (Particularly necessary when applied in confined places.); (9) Be pleasant to use from proper "workmen's attitude;" (10) Be appliable by regular plant personnel; (11) Give long utilitarian life and be economically feasible.

The final selection of a hot-applied elastic film, containing rust inhibitors and forming a tenacious bond on both

metal and concrete, best suited our purpose.

The success of any protective coating depends largely upon the care with which the surface to which it is to be applied is prepared. It is imperative that all surfaces and indentures be thoroughly clean. Metal surfaces should be cleaned to bare metal, free of rust and scale deposits; concrete surfaces should be cleaned to solid base, free of loose aggregate, spalled material and foreign substances.

After the sand and gravel had been removed from the steel pressure filters it was found that the interior metal surface was badly corroded and tuberculated. In many instances the original ½-in. metal thickness had been reduced to ¼ in. or less.

Different methods were used in attempting to remove this tenacious rust formation, the most successful of which consisted of a combination of hand and power-driven wire brushes, pneumatically operated cleaning tool and oxygen-acetylene flame-cleaning. The power cleaning tool and brushes removed the bulk of the rust. The flame-cleaner readily removed the remainder, leaving a residue or loose ash that was easily brushed off. Equipment used in the work is listed in Table 1.

Cleaning action of the pneumatic tool is supplied by a large number of cutters (toothed circular cutting wheels assembled into sets) loose-pinioned around the rotating head, which revolves at high speed, throwing the cutters by centrifugal force against the metal surface being cleaned. An adjustable depth shoe can be set to limit the impact of the cutters so they will not bite into or damage the permanent metal surface. The cutting wheels can be replaced with wire brushes when desired.

TABLE 1—EQUIPMENT USED IN CLEANING AND COATING METAL AND CONCRETE SURFACES

- Wire scratch brushes, 1 x 6-in.
- Wire scratch brushes, 2½ x 7¼-in.
- Air power brushes, 6-in. dia.
- Electric power brushes, 6-in. dia.
- Wall scrapes, 3-in.
- 1 Oxygen-acetylene flame cleaner
- 1 Electric exhaust fan, 400 cfm.
- 1 Electric exhaust fan, 1,400 cfm.
- 1 Gasoline-driven exhaust fan, 2,000 cfm.
- 1 Low speed electric drill, ¾ in.
- 2 Pneumatic buffers, ⅜-in.
- 1 Pneumatic cleaning tool
- 1 Natural gas torch, 3 x 4-in.
- 1 Portable heating torch, 4-gal. capacity.
- 1 Heated-pump applicator, 1 gal. capacity.
- 1 Heated-pump applicator, large capacity.
- 2 Burner, gas hot plate
- 1 Electric air compressor, 115 cu. ft.
- 2 Shielded immersion thermometers, 600 deg. F.

Two passes needed in flame-cleaning

The application of oxygen-acetylene flame-cleaning to heavily corroded steel filters represents an initial adaption of the process to this type of work. Instead of the usual single-pass technique recommended for new steel, it was found necessary to resort to two passes of the flame cleaner. The first pass acts on the outer layer of encrustation; the second penetrates well down into the pits and seams.

The flame-cleaner consists of a regular welding blowpipe with quick-operating valve, but with extended handle terminating at a ½ x 6 in. flame head (Fig. 1). This head is designed to produce a series of special high-temperature (6,200 deg. F.), high-velocity, oxygen-acetylene flames producing the stringent heating necessary to remove rust. Best results are obtained when the flame impinges at an angle of about 30 deg. to the metal surface. Spaced the proper distance from the surface by two end skids, the head is well protected against damage and can be pushed into corners, as well as over rivet heads and joints, without harm.

Oxygen and acetylene for the flame-cleaner are supplied through two hose leads from a regulated multi-cylinder manifold outside the filter tank. It was found necessary to move the cleaning head at a rate of about 5 to 10 ft. per min. over the heavily corroded metal, as contrasted with the 25 to 35-ft. per min. movement usually acceptable on new steel.

A 1,200 cfm. exhaust fan furnished fresh air to the filter tank through a bottom manhole.

To free the metal from condensation and occluded moisture it is desirable to heat metal surfaces before applying the hot protective coating. This was accomplished by passing either a heating torch of the lead-furnace type, or a large natural-gas flame, rapidly over the surface of the metal. It should be emphasized that, in using any type of heating torch or flame for this purpose, care should be exercised to maintain an oxidizing flame. If a reducing flame were used, carbon or smoke deposits formed on the metal surface would seriously limit bond effectiveness.

The rustproofing material was applied with a small portable, heated-

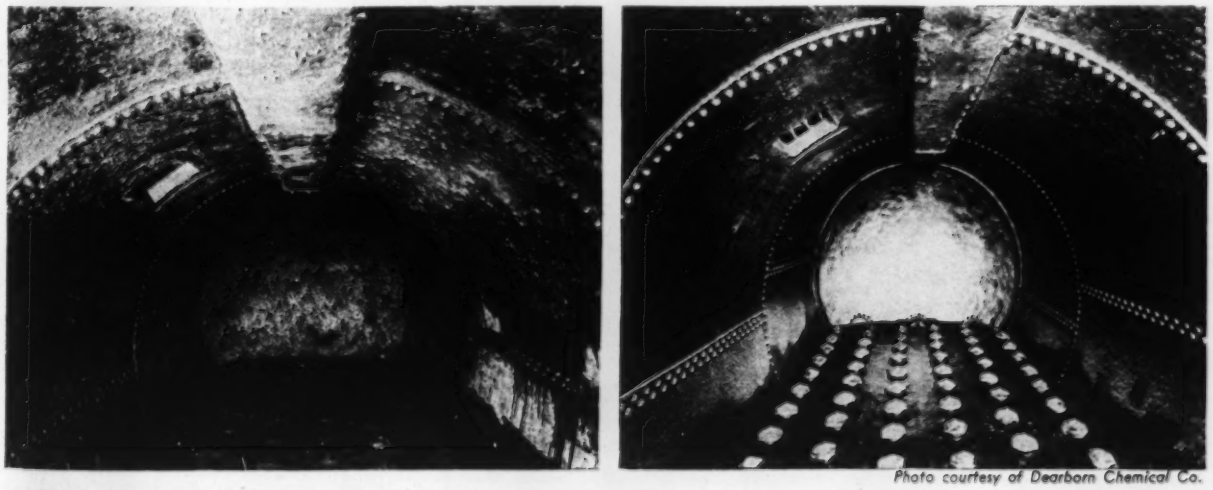


Photo courtesy of Dearborn Chemical Co.

Fig. 2. Interior of badly-corroded, 50-yr. old steel pressure filter shell before and after cleaning and rust proofing.

Fig. 3. After major breaks had been patched, concrete filter walls were waterproofed with the same material used to rustproof the cast iron underdrains.

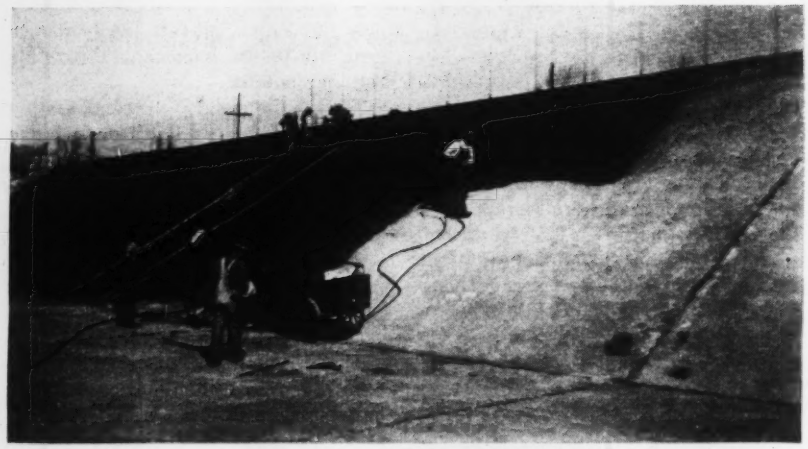


Fig. 4. Large-capacity applicator was used to apply compound as waterproofing on concrete lining of 5-mg. clearwater reservoir. The coating was smoothed by flaming with a portable all-purpose torch.

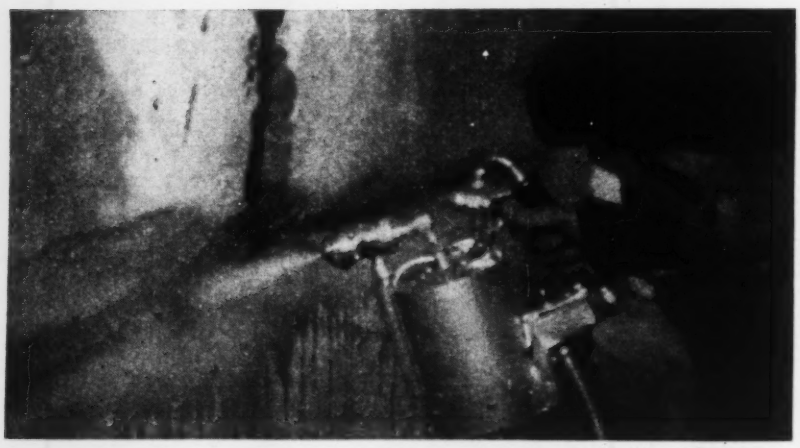


Fig. 5. Waterproofing compound was applied as a temporary measure with a small portable heated-pump applicator to reinforced concrete filter walls that had developed large cracks. After 5 yr., these repairs are dry and tight.

pump applicator holding 1 gal. and delivering from 0.15 to 0.20 gal. per minute. The compound was heated (300 to 350 deg. F.) in a 100-lb. capacity kettle on a gas burner outside of the filter and carried to the operator as needed. An adjustable thermostat on the applicator maintained a uniform temperature in the pump, which operated from a 110-v. alternating current electric circuit.

Coating flamed with torch

The protective coating was built up in two applications, the work being done from the bottom to the top of the tank in horizontal sweeps. After the first application, the coating was flamed with a torch to smooth the laps into a continuous film.

A second application, made in similar manner to the first and flamed smooth to a uniform total thickness of $\frac{1}{32}$ in., gave a dense bond coverage (Fig. 2, right) of about 75 sq. ft. per gal. of material. All coated metal surfaces were checked against "holidays" and thin spots with an electric detector set at a dielectric resistance of 10,000 volts. Holidays and thin spots were a rarity, however, as it is surprising what proficiency can be attained by an operator after a relatively brief period of practice. Man-hours required (per 1,000 sq. ft.) for cleaning and coating different types of surfaces are shown in Table 2 on facing page.

Although the reinforced concrete filter walls and bottoms were badly cavitated and irregular, no effort was made to bring them to a uniform smooth surface before waterproofing. However, major breaks were patched with neat-cement mortar. The concrete was then carefully hand brushed, cleaned of all loose particles, washed down and permitted to dry.

Waterproofing the concrete surfaces

When the concrete surface was thoroughly dry, the waterproofing material (same as rustproofing) was put on it in two separate applications. The method of application was identical to that used on the metal, the material being applied from bottom to top in 3-ft. sweeps 6 in. wide. A torch flame was passed over the newly applied surface to smooth it into a uniform continuous lining.

The double application gave a waterproofing coat (Fig. 3) with a total thickness of $\frac{1}{32}$ in. Flaming before and

after each application magnified holidays and thinly coated spots. These were readily touched up with a blowtorch which, during the final touching-up and smoothing process, was held at a 30-deg. angle to the concrete surface so that a slight sweeping movement tended to facilitate filling all open pores, pin holes and the like.

For another job, when it was desired to apply a large quantity of rustproofing and waterproofing material, a large heated-tank applicator mounted on wheels was used (Fig. 4). This equipment operates on the same principle as the small unit, except that the heated material is circulated through flexible metal hose to a spray head accommodating large-volume application. While the pump capacity is 5 gal. per min., at normal application pressure of 50 lb. the nozzle delivery was 0.5 gal. per min. A portable, all-service heating torch proved best adapted for smoothing the protective coating on the large surfaces.

TABLE 2—CLEANING AND COATING VARIOUS SURFACES
(Man-hours required per 1,000 sq. ft.)

Type of Surface	Hand and power tools	Oxygen-acetylene flame cleaning	Coating and flame smoothing (2 coats)	Coating thickness, in.	Coating coverage, lb. per sq. ft.
New metal, smooth	12	1.5 (1 pass)	3	1/32	0.15
Old metal, rough	66	8 (2 passes)	4	1/32	0.18
New concrete, smooth	4		3.2	1/32	0.17
Old concrete, rough	29		3.5	1/32	0.21

Large wall cracks repaired

Still another use was found for the compound. Concrete filter walls of a water purification plant, built a few years ago adjacent to the plants previously described, had been in service but a few weeks when three large vertical cracks developed the full depth of the filter units (12 ft.) The cracked wall, which was also a load bearing wall for the superstructure, was 12 in. thick and 15 ft. above the foundation. Unequal settlement, due to variation in bearing values of foundation materials (rock and clay), is thought to have caused the cracks.

After sand and gravel were cleared from the cracks, spalled material and loose aggregate both inside and outside were chipped away and the cracks cleaned with high-pressure air and water. Next, they were filled with neat-cement mortar within 3 in. of the wall face and the remainder filled with successive coats of waterproofing (Fig. 5). Care was taken to flame the surface after each application.

The work was carried out during inclement November weather, repairs of a more permanent nature being scheduled for the following spring. Later it was found that the cracks were sealed so well it was unnecessary to make further repairs. The temporary repairs, made five years ago, are still dry and tight.

Where the items to be cleaned and treated are removable and small enough to be so handled, the compound has been applied by dipping. Some 900 cast iron, bronze-face filter gate valves and other fittings, varying in size from 4 to 24 in. and with service records of from 20 to 50 years, have been treated in this way (Fig. 6, left).

This equipment was disassembled, and cleaned by sand blasting. Prior to the sand blasting operation all bronze surfaces were brush covered with hot compound to protect them from the cutting sand.

After this cleaning, the entire assembly was dipped in rustproofing heated to 250 deg. F., reassembled and tested. Dipping time varied from 2 to 5 min., depending on the size of casting and the number dipped at one time. The object was to obtain a uniform protective coating $\frac{1}{32}$ in. thick on all surfaces. Shop-made dipping facilities for doing this work are shown in Fig. 6, right.

The compound used in the work described above is a product of the Dearborn Chemical Co., Chicago, Ill.

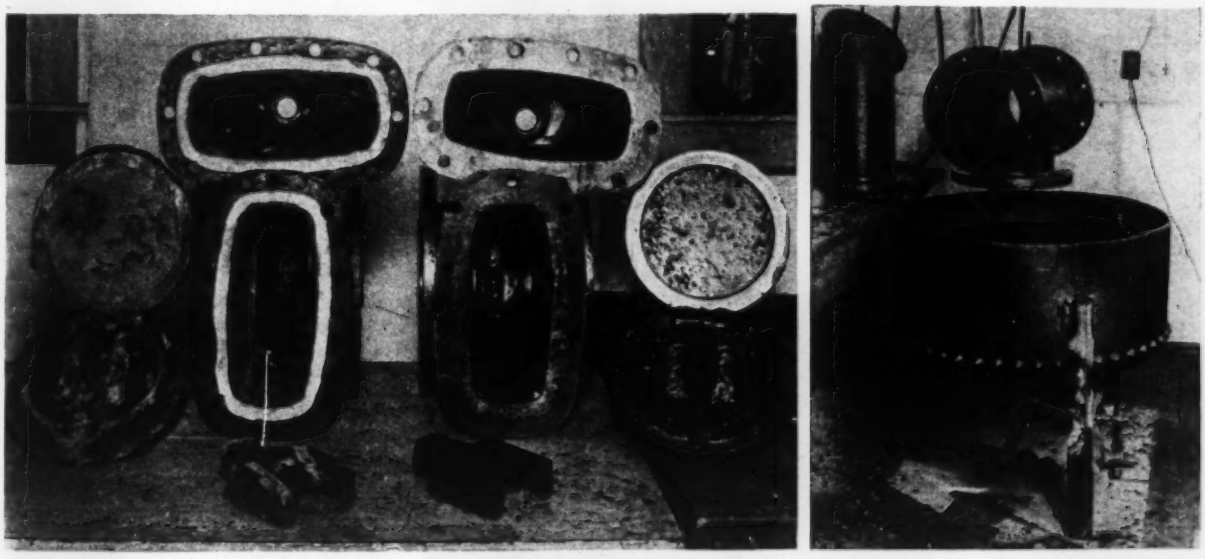
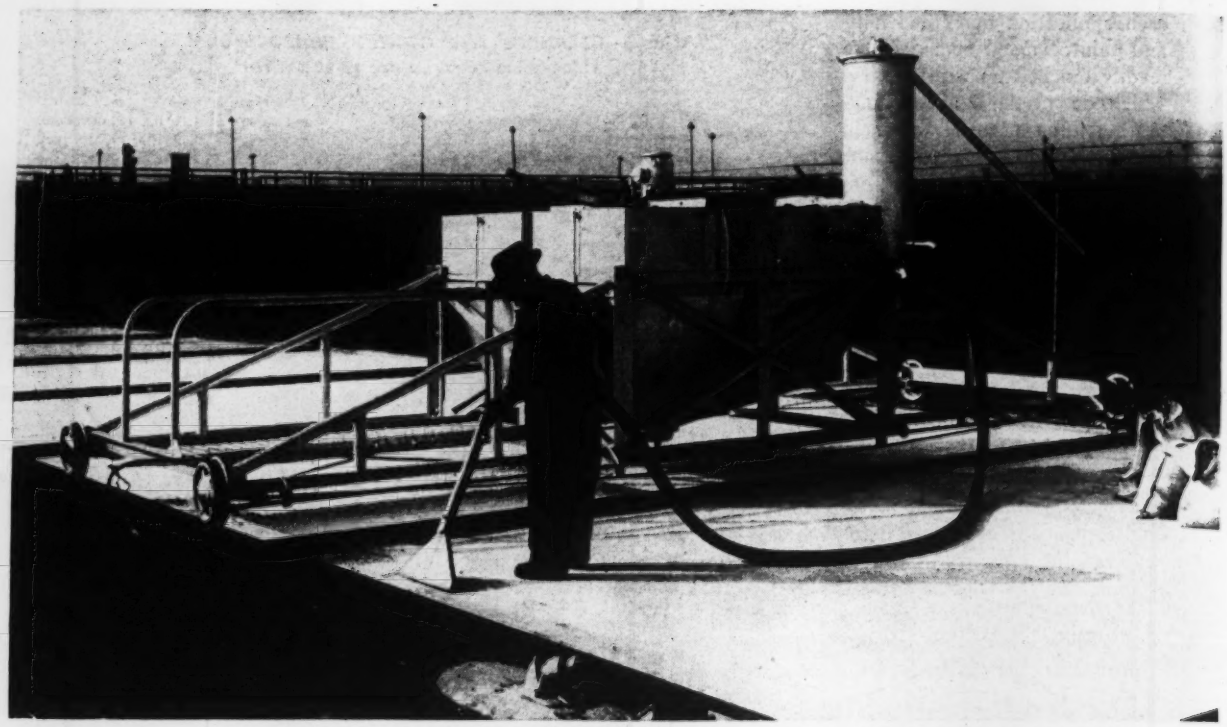


Fig. 6. Cast iron gate valves and fittings with service records of 20 to 50 yr. were cleaned by sandblasting, then dipped in hot rustproofing compound. Shop-made dipping facilities, shown at right, use a domestic-type gas burner for heating the compound. A uniform protective coating 1/32 in. thick on all surfaces was desired.



Vacuum-cleaner-like suction lift harvests the zeolite from drying beds preparatory to final processing and storage.

Los Angeles Makes Its Own Zeolite

BECAUSE OF DIFFICULTY in securing commercial zeolite, the Metropolitan Water District of Southern California since the middle of 1945 has been manufacturing this product for use in the district's water softening plant near La Verne, Calif. This plant, operated since 1941 and said to be the largest water softening and filtering plant in the world, had started with zeolite obtained through commercial sources. However, additional amounts were required to replace that lost through attrition. During the year 1944-45 the plant hardness removal averaged 329 ppm. for some 30,000 acre-ft. of Colorado River water treated.

Zeolites commonly used in water softening include the natural substance known as greensand, as well as various forms of synthetic sodium zeolites. As used in the district's plant, the substance is a white, granular material having the appearance of damp rock-salt and possessing about three times the softening capacity of natural zeolite.

In the softening process the sodium radical of the product (an artificially prepared sodium aluminum silicate) is interchanged for calcium or magnesium, the main source of hardness in water. District chemists found that the zeolite could be made from a mixture of sodium aluminate and sodium silicate.

Special gantry aids manufacture

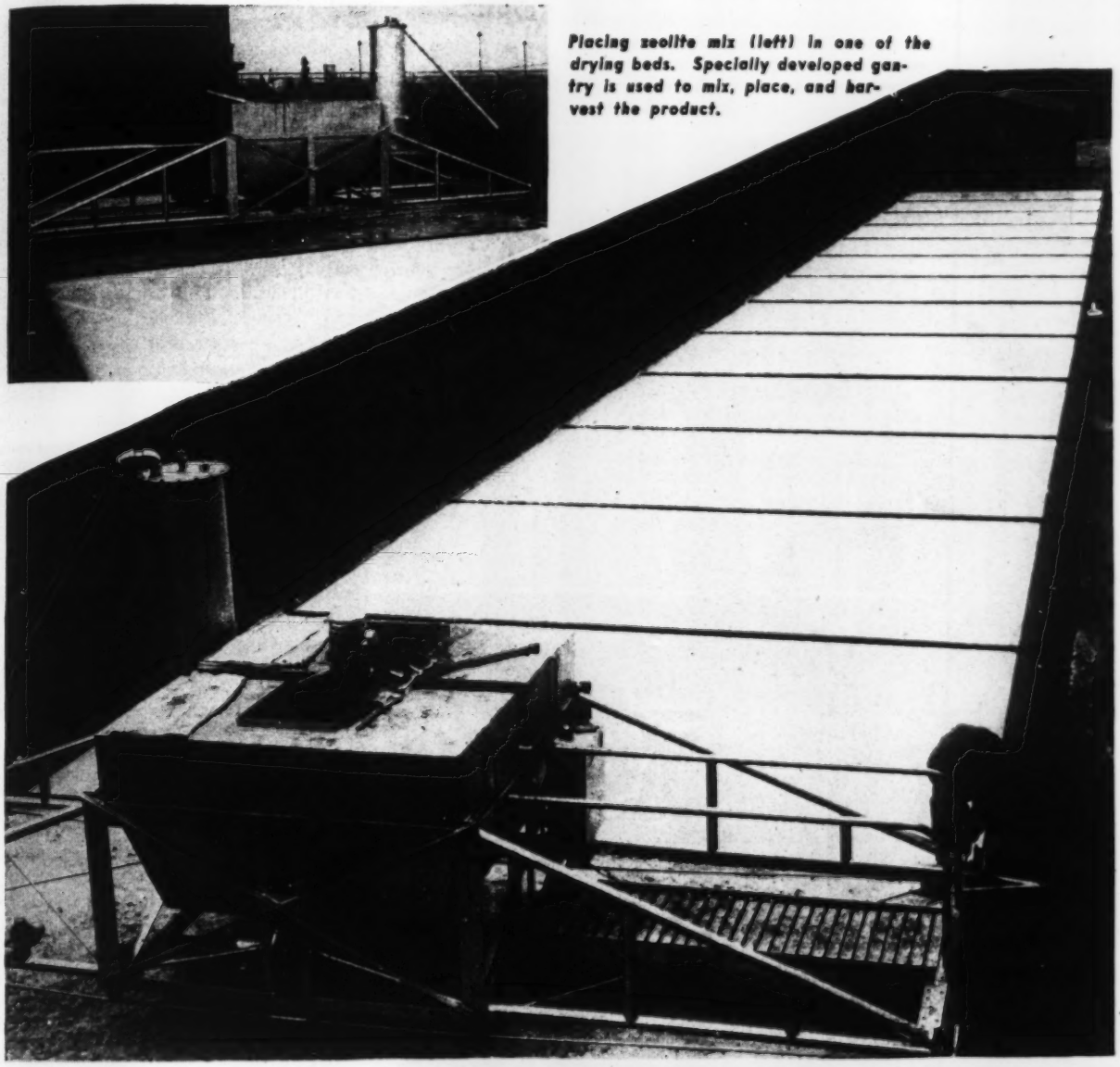
To aid in the manufacture, the district developed a special gantry performing the three primary functions of mixing, placing, and harvesting the zeolite. A 250-gal. solution of each of the two raw materials is prepared and placed in two separate reservoir tanks on the gantry. The gantry, powered by an electric motor and straddling the drying area, is then run to one of the fourteen drying panels, each having an area of 400 sq.ft.

When over the panel to be used, the two solutions are dropped simultaneously from the reservoir tanks into a 600-gal. mixing tank on the gantry, where they are mixed for about 30 sec. by a high-speed stirring mechanism. A large dump-valve on the bottom of the mixing tank is then opened and the mixture quickly drained onto the drying area.

After the solution takes its initial gel and before it has hardened, the zeolite is cut by wires attached to the gantry. This cutting is done so that the material does not harden in large pieces.

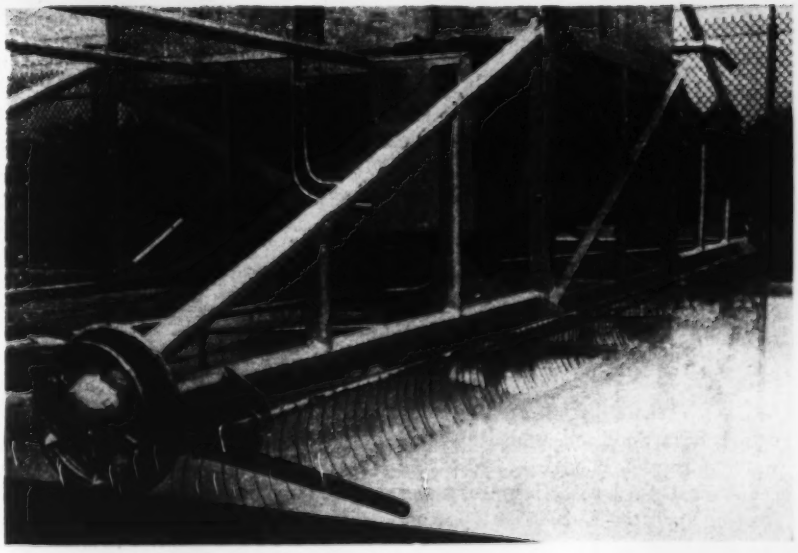
After the material has dried sufficiently, the gantry harvests it by means of a suction lift, not unlike a large vacuum cleaner, and collects it in cloth sleeves within the vacuum chamber. Before use in water softening, the newly made zeolite is screened, the oversize material being fractured to size in a roll crusher and the fines (about 2 percent) being discarded.

The necessary machinery and operating equipment were fabricated by the Metropolitan Water District in its softening plant machine shop under the direction of A. E. Preston, mechanical foreman. Plans and specifications for the manufacture of the zeolite were prepared by Lee Streicher, the district's chemist.



Placing zeolite mix (left) in one of the drying beds. Specially developed gantry is used to mix, place, and harvest the product.

Drying beds (above) with gel freshly placed in each of the panels. Utilization of natural drying is possible because of nearly ideal climatic conditions.



After the zeolite gel has taken its initial set, stiff wire fingers attached to the gantry frame break it up into easily handled sizes by scarifier action.

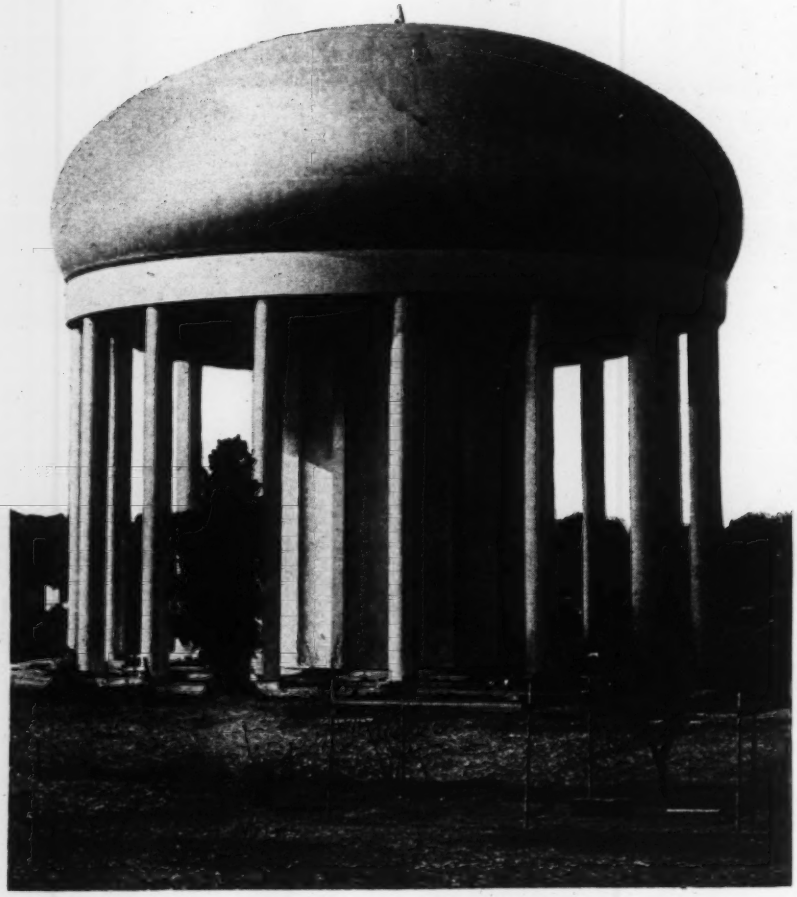


Fig. 1. A new 2-mg. elevated tank in Washington is distinguished by the use of a 40-ft. dia. fluted central column. This member is not filled with water, a 5-ft. riser inside the column providing the connection between the tank and the distribution system.

Fluted Central Column New Feature in Tank Design

R. M. Dowe
Construction Engineer, Water Division, District of Columbia

***Contents in Brief**—Utility and esthetic appeal were combined in an elevated water supply tank for Washington, D. C., employing an all-welded design. The tank is a 106-ft. dia. spheroid supported on sixteen 4-ft. dia. outer columns and a 40-ft. dia. fluted central column. As part of the design analysis, a model of the central column was built and tested in compression. Steel erection, accomplished with a guy derrick, was expedited by means of patented "fitting up" plates; the latter were developed especially for steel plate erection and used to a limited extent on ship construction during the war.*

RECENTLY the District of Columbia completed a 2-mg. all-welded elevated water tank of a new design featuring economical first cost, long life and pleasing appearance. Bids for the structure were less than those for more conventional type tanks, and because of the simple lines of the structure, low maintenance costs are expected.

The tank was erected in the southeastern section of Washington near the intersection of Alabama and Boulevard Avenues. Because this area of the city is almost entirely residential and a region of high property values, appearance of the finished tank called for special attention.

Generally, elevated tanks are constructed of steel because this material is usually the best for this type of work. However, the bare utilitarian aspect of most elevated steel tanks does not always appeal to the esthetic sense. To meet this criticism, elevated steel tanks sometimes have been encased in masonry enclosures costing more than the tanks themselves.

Design selected is economical

With these facts in mind, several steel tank fabricators were requested to submit plans for a tank that would combine reasonable first cost, utility and esthetic appeal. Fortunately, when bids were solicited, the price for the structure finally selected was less than that for a tank of more conventional design.

The design chosen called for a spheroidal tank of 106-ft. dia. It is supported on sixteen 4-ft. dia. outer columns and a 40-ft. dia. fluted central column. All of the smaller columns are 52 ft. 6 in. high; they are evenly spaced along a circle of 96-ft. The central column, 47 ft. high is made up of plates about 8 ft. wide and bent to a radius of 9 ft. The large column is not filled with water, a 5-ft. dia. riser pipe inside this cylinder connecting the main body of the tank with the distribution system. Total height of the structure is 99 ft. The low water level is 49 ft. above the ground, and the tank will have a range in head of 34 ft. 6 in. All design is in accordance with AWWA specification 7H.1-1943.

To check the design of the fluted cylinder, a model of this member was tested in compression at the University of Illinois. The model was built of .08-in. thick metal on a scale of 1 in.

to 1 ft., the model being 48 in. high and 41 in. in extreme outside diameter. Maximum load supported corresponded to a unit stress of 27,000 psi. in the prototype. Standard column design would allow a working stress of about 13,500 psi., which compares with the actual design stress of 6,100 psi. A 41-in. dia. smooth cylinder of $\frac{1}{16}$-in. thick metal was also tested. Result of the latter test indicated that the fluted cylinder has much structural merit.

Fluted column carries wind load

In designing the foundations, which consist of spread footings, it was assumed that the weight of the water over the 5-ft. riser would be carried downward by this pipe to the center footing. It was further assumed that that portion of the bottom steel plus the water contained in an imaginary 60-ft. dia. vertical cylinder (minus the 5-ft. dia. central column of water) would be supported on the fluted central column. These assumptions required that the outer columns carry the remainder of the water, the snow load, all of the upper steel, and the remainder of the bottom steel. Since there is no wind bracing between the outer columns the 40-ft. dia. fluted central column had to be designed to carry the entire wind load.

Maximum loads on the foundations were calculated at 88.5 tons on the center pier, 3,806 tons on the 40-ft. dia. continuous footing under the fluted cylinder, and 416 tons on each of the sixteen outer piers. The foundations were designed for a maximum soil pressure of 5,000 psf. However, this value was not adopted until after a bearing test 6 ft. below the surface at the center footing indicated excellent supporting value. As a further study of the soil structure, two borings on a 100-ft. dia. circle and carried to a depth of 70 ft. below the surface were made.

At the start of steel erection a gin pole about 30 ft. long was used to raise the 68-ft. boom of the guy derrick employed to erect the tank. Next, the boom was used as a gin pole to erect, first the 5-ft. dia. riser pipe, which was 45 ft. 7 in. high, and then on top of this pipe the 90-ft. mast of the derrick. Finally the boom was lifted into place. The derrick was then used to erect all the steel.

Box girder transfers tank load

As a first operation in this work, the fluted central column was constructed. The rolled plates were delivered in sections equal to one-half the height of the cylinder, all of the lower plates being completely assembled before the top sections were added. The base of the bottom plates was welded to a 26x1$\frac{3}{4}$-in. continuous plate bolted to the concrete footing with 2$\frac{1}{2}$-in. bolts on an 8-ft. spacing. This plate was supported on shims, the

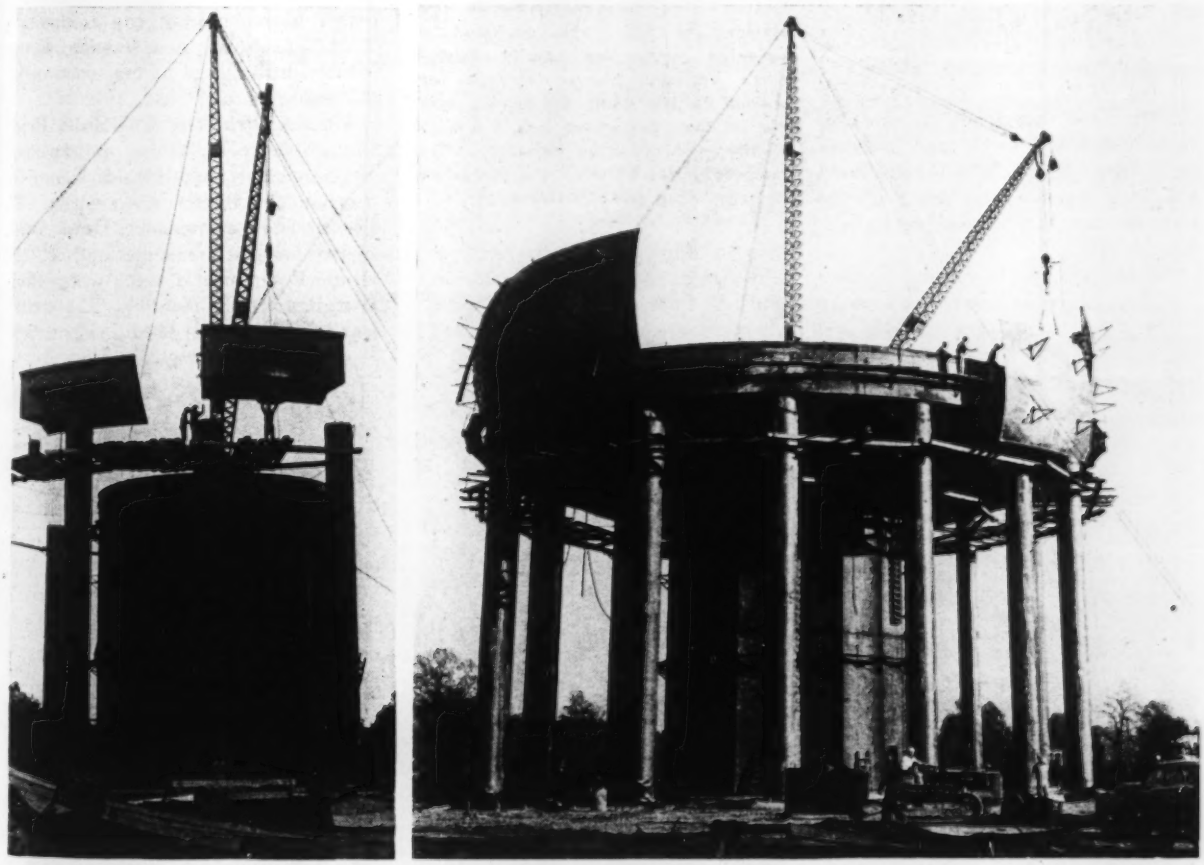


Fig. 2. Erection of the triangular shaped girders used over the outer columns followed closely behind erection of these members. This girder was completely assembled before construction of that portion of the tank's bottom between the outer columns and the fluted central cylinder was begun. Right: To speed erection of the shell of the tank, the general practice was to assemble four of these plates on the ground and raise them as a unit.

space below the plate later being filled with cement grout. At the top of the fluted cylinder a box girder is used to transfer the load from the bottom of the tank to this cylinder.

That portion of the bottom of the tank between the riser pipe and the fluted column was erected before the outer columns were raised. To reduce field work, the latter columns were delivered to the job in one section. This plan permitted a column to be erected in a few hours, the member being supported on shims of about 2-in. total thickness until the tank was completely assembled, when the space below each column was filled with grout. Each column is tied down with two $1\frac{3}{4}$-in. dia. bolts.

Some assembly on the ground

Erection of the sides and roof of the tank was expedited by welding together on the ground two or more of these plates and then raising this steel as a single piece. The plate members were held together (Fig. 3) and the correct spacing of the joints obtained by use of patented "fitting up" devices (*ENR* Mar. 22, 1945, vol. p. 389) used exclusively by the Chicago Bridge & Iron Co. and its licensees. These devices were likewise used for tying together and lining up the sections when they were raised to their final position.

General practice in welding together the plates of the tank shell was to make a continuous weld from one side and then to chip out from the other side with pneumatic hammers the inner portion of the weld (Fig. 4). Finally, all the space on the second side was filled with a continuous weld. AWS E-6010 electrodes were used almost entirely. The size varied from $\frac{5}{32}$ to $\frac{1}{4}$ in. in diameter.

Fig. 3. Temporary connections between sections of the tank consisted of patented "fitting up" plates held in place by pins passing through lugs welded to the steel. By driving other pins at the sides of the lugs, the width of the joint could be adjusted. Other temporary ties between the plates can be seen along joint illustrated.

Current for the welding work was supplied by six 400-amp. direct-current machines. Each unit was mounted on a pair of skids to permit the machine to be shifted around on the ground as desired.

Power for the derrick was supplied through a dual-drum hoist originally designed for operation by steam but with the cylinders reconditioned to use compressed air. The air was supplied by one 320-cfm. and one 200-cfm. compressor, both units discharging into a 5x12-ft. cylindrical storage tank.

Contractors and engineers

Foundations for the tank were built by Leo Butler Co., Silver Spring, Md. Remainder of the construction and design of the tank was by the Chicago Bridge & Iron Company; James C. Vosburgh is manager of the company's Washington office, and foreman E. C. Manson had charge of the erection of the tank.

For the District of Columbia, Brig. Gen. Gordon R. Young is engineer commissioner and Harold Kemp is director of sanitary engineering. H. Beckett is superintendent, Dave Auld, assistant superintendent, and R. L. Orndorff, engineer for the water division, District of Columbia. The writer was in general charge of construction.

Fig. 4. In welding the joints in the bottom of the tank, a continuous weld was added from the under side and the top of the weld chipped out from above (left). After the joint had been cleaned out and the rough edges removed (center) a continuous weld was added on the upper side to complete the weld (right).

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Old Things in New Wrappers

Sir: Both Mr. Merritt's and Prof. Brumfield's methods (*ENR*, Jan. 24, 1946, vol. p. 143) are based upon one-cycle moment distribution and the parts dealing therewith are the valuable parts of their articles. The writer believes that the parts dealing with criteria for moving loads are too involved and limited.

Mr. Merritt's moment ratios and Prof. Brumfield's transmission coefficients are none other than the modified carry-overs (or reciprocals) of one-cycle moment distribution. Also, the distribution factors and the balancing operations are the same. Regardless of claims for originality, this old and established method should not have been presented to the engineering profession at this late date as something new. Prof. Brumfield is especially at fault since he states in a paper in *Proceedings*, American Society of Civil Engineers, May, 1945, that "the concept of the transmission coefficient will be introduced" and "methods will be developed for distributing moment . . . in a single operation," etc. Changes in nomenclature and the addition of criteria do not change fundamentals and produce a new method.

An article, "A Direct Method of Moment Distribution," by T. Y. Lin, was filed in the Bancroft Library, University of California in April, 1933, and appeared in *Proceedings*, A.S.C.E., Dec., 1934, and again in the 1937 transactions of that society. While there was other previous work (pointed out in Mr. Grinter's discussion of the former), this article first brought one-cycle moment distribution clearly before American engineers and emphasized its value. It was discussed by many engineers and there have been frequent references to it. One-cycle moment distribution has long been established and is now widely used, especially in the West, where it has been taught to graduate students for many years at the University of California.

The writer considers one-cycle moment distribution, starting with fixed-end moments and ending with influence lines, the best method of solution for the particular case of one story continuous rigid frames composed of prismatic or nonprismatic members, and carrying moving loads.

BRUCE JAMEYSON
Professor of Civil Engineering
University of California
Berkeley, Calif.

Deep Pneumatic Piers

Sir: In the February 7th edition of the Record I noticed an article on page 112 (Vol. p. 176) also photo of the Santa Fe Railway Bridge at Topock, Ariz., which states that this bridge has the deepest pier ever constructed by the pneumatic method at a depth of 123 feet.

During 1926 and 1927 The Foundation Company of N. Y., (George L. Freeman, chief engineer), had a contract for the substructure of the Carlton Bridge across the Kennebec River at Bath and Woolwich, Maine, on which I was superintendent; J. A. L. Waddell, consulting engineer and C. K. Allen, resident engineer. This bridge was a combination highway and railroad bridge and built under the direction of the state highway commission of Maine; Paul D. Sargent, chief engineer.

Pier No. 2 of this bridge was taken to a depth of 123.7 ft. from high water.

R. B. ALSOP
Westfield, N. J.

Simplifying Azimuth Calculations

Sirs: The method of reducing azimuth observations proposed by T. F. Hickerson (*ENR* Nov. 15, 1945, vol. p. 682) is ingenious and new to me. However, it can hardly be claimed that the use of haversines is being discontinued because tables of secants and cosecants are now available; I imagine that the latter tables were used by mariners long before the idea of the haversine was conceived.

It is my opinion that the haversine and other "fancy" formulas have no advantage (except in aerial navigation) over a simple transformation of a fundamental formula of spherical trigonometry. This formula, long known as the Mariners' Formula, is:

$$\cos \tfrac{1}{2} Z = \sqrt{\sec h \sec \phi \cos s \cos (s - p)}$$

where h is the altitude; ϕ the latitude; p, the star's polar distance ($= 90° - \delta$); and s is $\frac{1}{2}(h + \phi + p)$.

This formula requires only the use of cosines and secants, and enables the calculation to be set out very compactly. The calculation, using the date given, would be made thus:

h	$= 31° 25.0'$	log sec $= 10.06885$
ϕ	$= 37° 58.3'$	log sec $= 10.10330$
p	$= 77° 54.4'$	
	$2\overline{\vert 147° 17.7'}$	
s	$= \overline{73° 38.85'}$	log cos $= 9.44955$
$(s - p)$	$= 4° 15.55'$	log cos $= 9.99880$
		$2\overline{\vert 19.62050}$
		log cos $\frac{1}{2} Z = \overline{9.81025}$
		$\frac{1}{2} Z = 49° 45\ 5'$
		$Z = N99° 31.0'$ E

It must be admitted that this method involves less "fiddling about" than any of the other methods so far put forward in the discussion and requires only 5 visits to the mathematical tables—the same number used by Mr. Hickerson.

G. J. THORNTON-SMITH
Senior Lecturer in Surveying
University of Melbourne
Victoria, Australia

Soil Mechanics in 1906

Sir: Reference is made to the letter titled "Soil Mechanics De Luxe" by R. M. Conner, consulting engineer of Los Angeles, Calif., (*ENR* Dec. 13, vol. p. 775).

During the year 1905 and to March 1906 I was principal assistant engineer on the Belle Fourche Dam in South Dakota, to which Mr. Conner referred, having charge of surveys, borings, soil investigations and assisting in the design of structures in connection with the dam. During this period a large number of borings were made to determine the nature of the foundation material, and samples taken from test pits in the borrow area were tested for water content, fineness, density and permeability.

The soil used in the construction of the dam was a very heavy gumbo which contained in its natural state about fifteen percent of moisture and weighed from 133 to 138 lb. per cubic foot. The soil was very hard

Steam-propelled traction engines with lugs on the large wheels were used to roll the gumbo in Belle Fourche Dam after light rollers had proved ineffective.

in its natural state, for example, the shovel teeth made deep marks in the face of the cut in the borrow pit and the material stood almost vertical during excavation, and one test pit 5x5 ft. was sunk in the borrow area to a depth of 30 ft. without sheathing. That pit stood without sheathing until the steam shovel reached it about 2½ years later.

I continued as principal engineer in charge of construction of the dam from March 1906 until its completion in 1910. As a result of our many tests on the soil samples, it was decided that it should have about the same density in the dam as it had in its natural state in the pit. Accordingly the governing specifications required rolling in 8-in. layers with sufficient water added to cover evaporation losses. To accomplish this it was necessary to add by sprinkling approximately 25 gal. of water per cubic yard. This additional water took care of the loss of moisture due to evaporation during excavation, hauling, spreading and rolling and provided enough additional moisture that it was possible to approach maximum density with the equipment then available.

Compaction was first tried with a small tandem steam-driven asphalt roller. Due to the slick nature of the gumbo soil, the uneven surface and the necessity of replacing the lost moisture, the small roller proved inadequate and often became stalled. After an unsuccessful try with the light roller, rolling was performed with two 16-ton steam-propelled traction engines with very large driving wheels equipped with lugs. These rollers are shown in the accompanying photograph, taken during the early stages of construction.

Irrespective of what might be said about the technique, a lot of time was spend on the job in carrying out what was then called soil tests and is now called soil mechanics.

I have not had personal connection with the Bureau of Reclamation since December 1914 but I believe the engineers of that bureau are making good use of soil mechanics. We engineers in "Public Roads" have gone into this subject quite extensively and are satisfied that there is a scientific treatment for every soil encountered in highway construction when used as fill or subgrade for pavements.

FRANK C. MAGRUDER,
Highway Engineer,
Public Roads Administration

Geology at Pearl Harbor Vaults

Sir: In order that readers of the very excellent article on the Underground Oil Storage Vaults on Oahu by N. A. Bowers (*ENR* Dec. 27, 1945, vol. p. 873) will not be misled by his reference to "alternating layers of cinders and conglomerate", an explanation is called for. The layers he calls "cinders and conglomerate" are in reality all parts of a thick series of volcanic lava flows.

Basaltic flows are of two sorts, "aa" and "pahoehoe". The former consists of a dense interior "blue rock" or trap, and an exterior of clinker or scoria which is loose, broken material. The pahoehoe is usually in thinner, vesicular layers that are continuous but which do not yield good crushed rock for aggregate or other uses. Because these different parts of two types of lava flows lie in successive layers they have some superficial resemblance to sedimentary rocks, such as conglomerate. Actually, the storage vaults are excavated totally in the volcanic lava flows; no sedimentary formation of any kind is penetrated by the vaults or the nearby tunnels except superficial gravel at one portal.

CHESTER K. WENTWORTH
Principal Geologist
Board of Water Supply
Honolulu, Hawaii.

Soil Consolidation

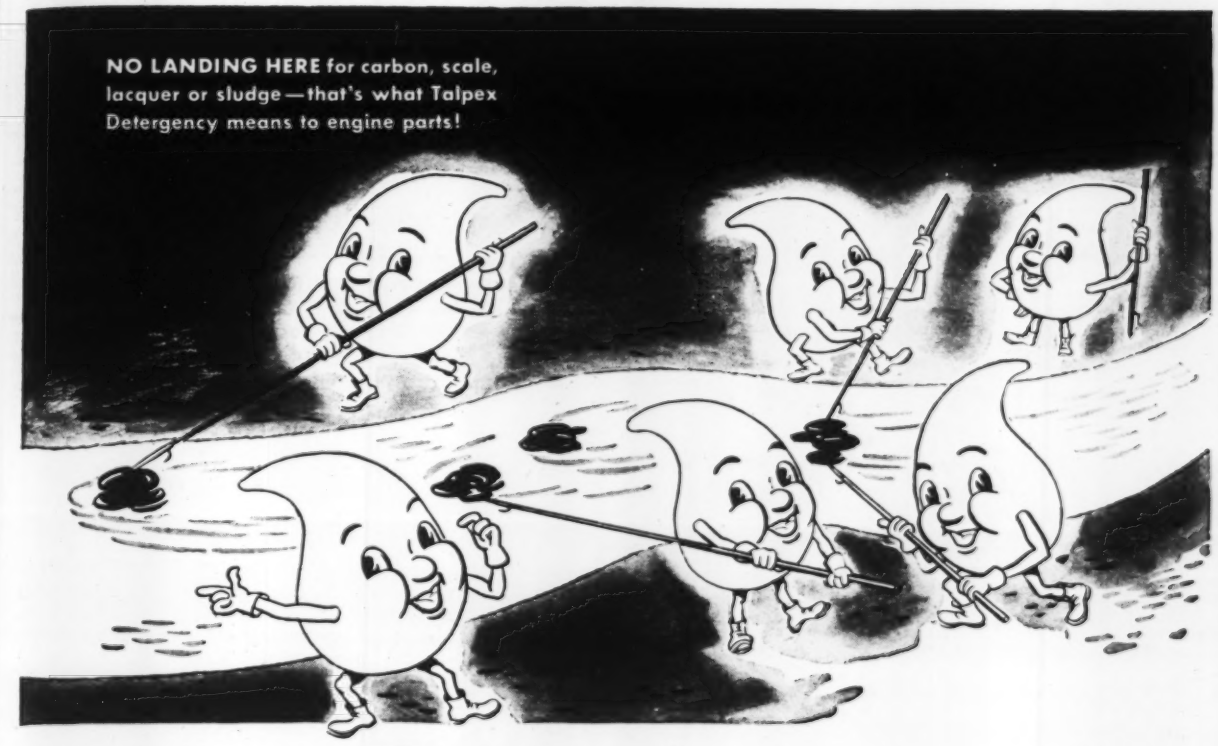
Sir: In the next to the last paragraph on page 86 of your March 21 issue you give a definition of "Vibroflotation" which may convey to your readers a wrong picture of this process. Having been connected with the development and with the testing-out of "Vibroflotation" in this country, I feel that, in justice to this remarkable invention, the definition mentioned should be corrected as follows:

"Vibroflotation is a patented process used for compacting granular soil in which a powerful vibrator is sunk to the desired depth of soil consolidation by means of vibration and a simultaneous upward flow of water, and then is gradually withdrawn as a downward movement of water is produced in the treated part of the soil compacted by simultaneous vibration."

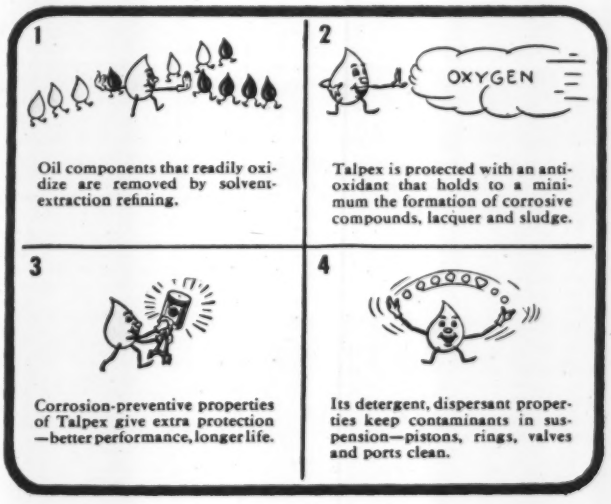
It is not proper to speak of "water jet" since no material is spilled during vibroflotation. When the vibrator dives, the soil particles in the path of the vibrator are thrown outward, thus opening the way for the sinking of the device and at the same time precompacting the soil. During the raising of the vibrator when the final soil compaction is accomplished, sand is fed into the hole around the vibrator and the soil is compacted without previous loosening.

This procedure makes it possible to compact fine granular soil, for example loose hydraulic fills, using suitable sand backfill.

EUGENE E. HALMOS
Consulting Engineer, New York.



THESE FOUR *TALPEX* PERFORMANCE FACTORS SAFEGUARD HIGH-SPEED DIESELS


1
Oil components that readily oxidize are removed by solvent-extraction refining.
2
OXYGEN
Talpex is protected with an anti-oxidant that holds to a minimum the formation of corrosive compounds, lacquer and sludge.
3
Corrosion-preventive properties of Talpex give extra protection—better performance, longer life.
4
Its detergent, dispersant properties keep contaminants in suspension—pistons, rings, valves and ports clean.

TALPEX has detergent properties that keep such contaminants as sludge and lacquer from depositing on pistons, rings, valves and ports. Not able to land at their favorite spots, they circulate with the oil until drained from the engine.

If the oil you are now using doesn't have detergent properties—if it hasn't been doubly protected against oxidation—if it doesn't have special corrosion-preventive properties—then you had better change to Talpex.

The Shell Lubrication Engineer will give you sound advice about the lubrication of *any* type of Diesel, whether slow, medium, or high speed.

Write for a copy of Shell's booklet, "The Fundamentals of Diesel Lubrication." Shell Oil Company, Incorporated, 50 West 50th St., New York 20, N. Y. or 100 Bush St., San Francisco 6, Calif.

SHELL

SHELL DIESEL LUBRICANTS

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

LUMBER led the price rise parade in May with $5 per M increases in New York; Chicago and Kansas City for both pine and fir. $5 rise for fir in Seattle, $4 to $5 in Montreal for spruce, $7 for fir, $6 for 1x6s and 1x8s in Minneapolis but 25c. to 75c. decreases in other sizes, $1 in Detroit for Southern pine and $1.25 to $4 rises in St. Louis. BRICK increased in Kansas City and Seattle and is very scarce in the latter city.

STRUCTURAL CLAY TILE went up in Seattle $6 to $8 per M with some sizes not available. ASPHALT is up in Chicago, $1 per ton; AGGREGATE prices 50c. to $1.15 in Boston; CAST IRON pipe is up $2 per net ton. COMMON LABOR is up 10c. for building work and the heavy construction minimum is up 5c. in Dallas and 12½c. in Philadelphia. CARPENTERS are up 19½c. in Philadelphia, 25c. in St. Louis. These changes raise the ENR 20 cities average for skilled construction workers to $1.772 for May and for common labor to $1.013.

CEMENT, AGGREGATE, READY-MIXED CONCRETE—F. O. B. CITY

	PORTLAND CEMENT — Per bbl., C/L lots, incl. 40c. per bbl. for bags, cash dis. not deducted			SAND AND GRAVEL — Per ton, carload lots			CRUSHED STONE Per ton, carload lots		CRUSHED SLAG Per ton, carload lots, f.o.b. plant		CONCRETE BLOCK 8x8x16-in.; truckload del.; per block		READY MIXED CONCRETE truckload 1:2:4, over 60 c.y., del.
	Cloth *a*	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand-grav.	Lt.wgt. Agg.	
Atlanta	$2.77	$2.52	$2.43	$1.79	$1.89	$1.65	$1.79	$1.89	$1.59	$1.69	$0.17	....	$9.00
Baltimore	2.62	2.37	2.12	1.80‡	1.80‡	1.30‡	1.80‡	1.80‡	1.75‡	1.75‡	.125	$0.125*w*	7.45
Birmingham	2.50	2.25	2.10	1.75	1.75	1.50	.85	1.00	.90	1.15	.1425	....	8.95
Boston	2.79*b*	2.72*b*	2.52	2.00‡	2.00‡	1.50‡	1.55‡	2.50‡	....	....	.13	.155*w*	7.55*m*
Chicago	2.90	2.65	2.50	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	1.75‡	1.75‡	.18	.18*x*	....
Cincinnati	2.51	2.26	2.06	1.20	1.20	1.10	1.80	1.80	....	....	.13	.17*w*	6.85
Cleveland	2.59	2.34	2.19	1.75*i*	1.75*i*	1.25/1.65*s*	1.80*s*	1.80*i*	1.15	1.15	.14	.14	8.15
Dallas	2.51	2.26	2.06	1.80*p*	1.80*p*	1.45*p*	1.72*p*	1.82*p*	....	....	.15	....	8.20
Denver	3.59	2.92	2.47	1.20	1.25	.90	1.65	1.75	1.00	1.00	....	.15	8.75
Detroit	2.59	2.34	2.16	1.75	1.75	1.55	2.25	2.25	2.00‡	2.00‡	.14	.15*w*	7.15
Kansas City	2.78	2.57	2.38	1.85	2.30	1.00	1.91	1.91	....	....	.16	.16*wy*	7.80*n*
Los Angeles	3.00*r*	2.40*r*	....	1.30	1.30	1.15	1.30*f*	1.30*f*	....	....	.04*ob*	.075*aa*	7.25
Minneapolis	3.13	2.88	....	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	.155	....	7.60*j*
Montreal	....	1.95*r*	1.79*r*	1.65‡*s*	1.65‡*s*	1.50*t*	.80*ct*	.90*ct*	....	....	.1999	.17*wt*	7.00*s*
New Orleans	2.41	2.16	1.92	1.67	1.65	1.22	....	....	.90	1.15	.19	....	9.25
New York	2.85‡	2.60‡	....	1.60*de*	1.60*de*	.90*de*	1.80*de*	1.80*de*	....	....	.16	.14*wee*	8.25*bq*
Philadelphia	2.73‡	2.48‡	2.28‡	1.55‡	1.65‡	1.20‡	1.90‡	1.95‡	1.10	1.10	.155	.155*w*	8.55
Pittsburgh	2.80	2.55	2.35	1.65‡	1.65‡	1.85‡	2.25‡	2.25‡	1.50	1.50	.17	.17*z*	8.55
St. Louis	3.08*o*	2.80*o*	....	1.75‡*o*	1.75‡*o*	1.65/1.75‡*o*	1.25/1.95*c*	1.25/1.95*c*	.90*g*	1.15*g*	.155	.18*yo*	8.60
San Francisco	2.21	2.01	1.71	1.36	1.36	1.36	1.46	1.46	....	....	...	.215*y*	7.55
Seattle	....	2.75*c*	....	2.35d‡	2.35d‡	2.35d‡	2.85‡*od*	2.85‡*od*	....	....	.16	....	7.25

‡ Delivered. *a* 10c allowed for each returnable bag. *b* 10c. per bbl off for cash. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 2 per cent for cash in 10 days. *l* 2000 lb. concrete. *m* 50c off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 10c per ton off, cash 15 days. *q* 5 cu. yds. or more. *r* 10c per bbl off, cash 20 days. *s* 8% sales tax included. *t* 8% sales tax not included. *v* 20c per bbl discount; 80c. per bbl. for bags. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Pumice. *bb* 4 x 8 x 12 in. *cc* Also 8 x 18 x 18 in.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c per bbl for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICE BASES AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable.

	Bagged	Bulk
Buffington, Ind	$1.90	$1.85
Dallas, Tex	....	....
Hannibal, Mo	1.90	1.85
Hudson, N. Y.	....	....
Independence, Kans.	1.90	1.85
Ironton, Ohio	$1.80*	$1.75*
Limedale, Ind.	....	....
Norfolk, Va.	....	....
Northampton, Pa.	1.75	1.70
North Birmingham, Ala.	....	....
Richard City, Tenn.	$2.00	$1.95
Steelton, Minn.	2.00	1.95
Universal, Pa.	1.85	1.80
Waco, Tex. (Plus 9c tax in Tex.)	1.75	1.70
Montreal City (Discount 10c. per bbl 20 days)	1.68	1.67

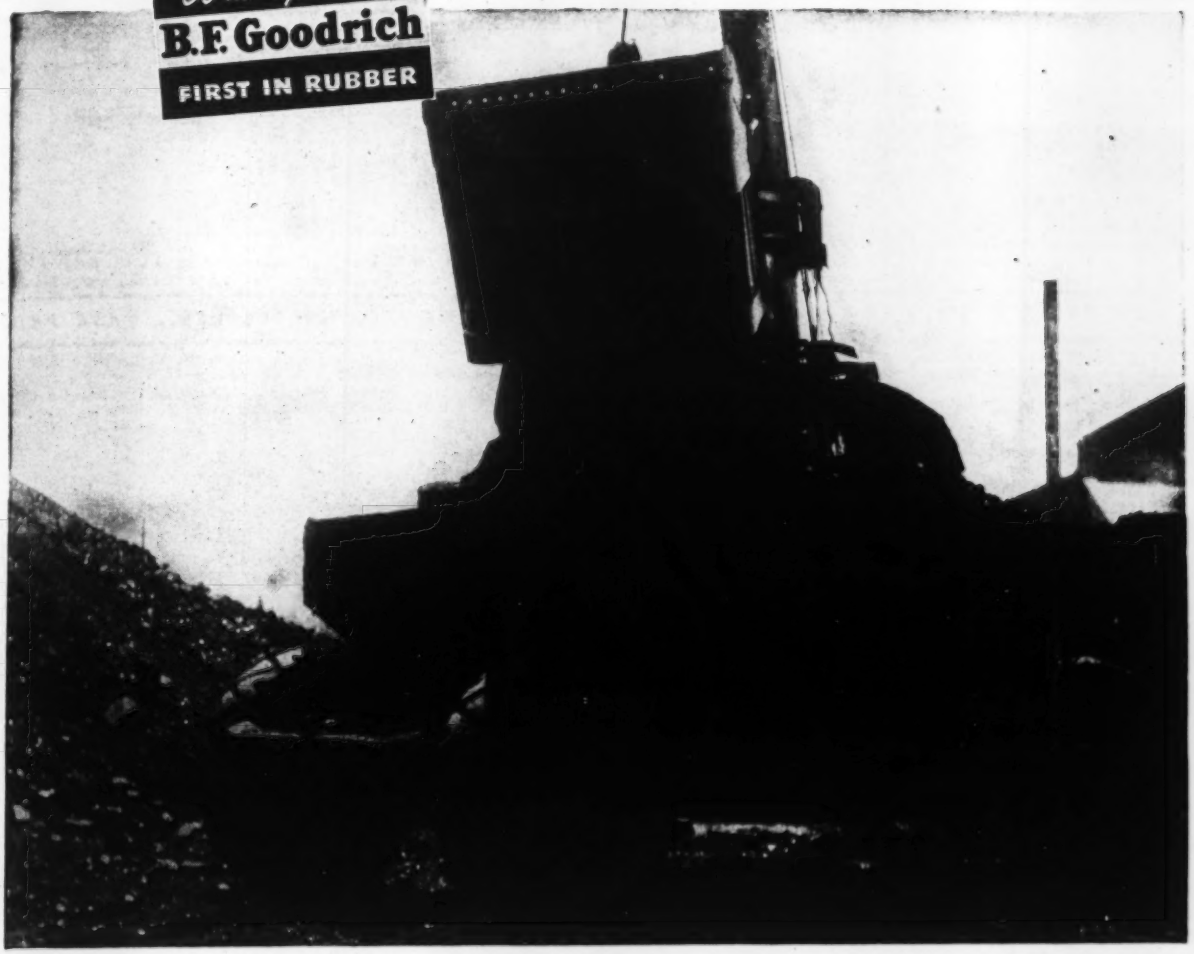
* Destination price base: effective Sept. 17, 1945.

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS—F. O. B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT Per ton, less than 80 penetration		ASPHALT BINDERS—FLUXES Per gal., 80–300 penetration		CUTBACK ASPHALT Per ton		ROAD OIL Per gal.	ASPHALT EMULSION (Quick-breaking) Per gal	
	Granite per M lots of 50,000 4x4x8 in.	Brick per M 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	.....	$2.25	.....	$14.00	$0.074	.....	$0.0806*h*	.....	$0.0781	$0.0806	.....
Baltimore	150.00‡	49.00	85.00*m*	15.00*r*	21.00*r*	.06*r*	0.09*r*	13.00*r*	23.00*r*	.06*r*	.07*r*	.14*r*
Birmingham	150.00	32.00*j*	.....	17.95	.....*l*	.0747	.....*l*	.0834*h*	.....*l*	.065	.095	.....*l*
Boston	85.00	59.00	3.75	15.00	24.00	.0625	.115	17.00	30.00	.0625	.0825	.145
Chicago	150.00‡	60.00*e*‡	2.85/4.00*d*	15.00	23.50	14.15*g*	22.65*g*	.0625*h*	.155*h*	.05	.09/.10‡	.13/.15‡
Cincinnati	120.00	55.75	.....	17.00	.....	.085	.....	12.25	.....	.07	.085	.....
Cleveland	127.50	39.00	3.87	17.00	19.00	.085	.095	.10*h*	.11	.08	.10	.....
Dallas	.....	40.00	.....	13.65	20.30	.06	.11	16.00	24.80	.06	.05/.07	.07/.09
Denver	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	37.00	.....	17.60*f*	26.56*f*	.0734	.128	.0718*h*	.119*h*	.067	.0974	.135
Kansas City	.....	44.00	.....	18.50	23.50	.077	.1075	.077*h*	.107*h*	.057	.11	.15
Los Angeles	.....	50.00	.....	9.00*b*	23.00*b*	9.50*bg*	24.00*bg*	9.50*b*	.....	.025*b*	.072*b*	.15*b*
Minneapolis	.....	.....	2.017*d*	.....	27.70	.....	.126	.....	32.64	.....	.....	.....
Montreal	70.00	.....	.....	16.60*k*	24.25*k*	.1035*h*	.111*k*	.1154*k*	.1354*k*	.08*k*	.135*k*	.188*k*
New Orleans	.....	.....	.....	13.50*a*	20.00*a*	.057	.088	.06*h*	.095*h*	.....	.080	.....
New York	.....	65.00	.....	18.56	25.35	15.15	.....	.073*h*	.133*h*	.0675	.075	.1240
Philadelphia	150.00	62.00	4.06	16.00	.....	15.00	.....	.0675*h*	.....	.....	14.00*gr*	.....
Pittsburgh	135.00	39.75	3.75	18.00	23.00	.09	.16	20.00	36.00	.07	.08	.13
St. Louis	.....	40.00	.....	14.80	19.80	13.80*g*	18.80*g*	.0587*h*	.1362*h*	.483	.07	.1215
San Francisco	.....	45.00*e*	.....	10.90	20.15	10.90*g*	.....	12.90	.....	.....	.0525	.1125
Seattle	.....	.....	.....	11.75*i*	22.75*i*	9.50	21.20*gs*	12.25*i*	14.75	11.75*i*	.0525*i*	.0625*i*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* F.o.b. Refinery. *c* 2½ × 8½ × 4 in. *d* 2-in. interior block, 6-lb. treatment. *e* 3½ × 4 × 8½. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* 3 x 3½ x 8½ in. *k* Tax included. *l* Quoted on request only. *m* Per thousand. *r* February 1943 prices, none later available.

A development of
B.F.Goodrich
FIRST IN RUBBER



It's what you can't see that makes this off-the-road tire last longer

HERE'S a story that may help you get more for your tire money. Rock and dirt hauling, like strip mining, is a tough life for tires—especially in wet weather. Traction gets bad. Slippage is a problem. Heavy loads strain the tire body. And when tires, under load, take shocking impacts from rocks and ruts—bruises, ply separation, and blow-outs often result.

To protect users against such losses, B. F. Goodrich engineers developed a special tire with unique features . . . the B. F. Goodrich Universal (shown above). The Universal has a tread with thick, heavy lugs that protect the undertread. But the tread is so designed that the natural running action pushes mud and dirt toward the edges. The tire stays clean. It gives excellent traction in *either* direction—resists side slippage.

B. F. Goodrich engineers went further. They developed an entirely new construction principle—the *shock shield.* It's a set of four breakers—layers of rubber-coated rayon cords—built in between the tread and the plies. These breakers are in pairs, with the cords in each pair running parallel to each other—but with each pair running in opposite directions to give balanced strength. The breakers are cushioned with thick layers of special shock-resistant rubber.

Under impact, the cords in the breakers stretch together, *not* across each other, and return to their original position. The blow is *distributed* and *absorbed* by the rubber cushions; the shock passed on to the cord body is greatly reduced.

Users of the Universal report fewer bruises, lower repair bills, longer wear, and say that more tires can be retreaded. One operator reports that B. F. Goodrich Universals averaged 4571 hours, compared to approximately 1600 hours from another make.

Supplies of most sizes of off-the-road tires are now quickly available. See the B. F. Goodrich dealer, or write us direct. *The B. F. Goodrich Company, Akron, Ohio.*

Truck Tires BY

B.F. Goodrich

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF BARS ¼-in billet *b*	RIVETS ½-in. structural	WIRE NAILS Base	SHEET PILING Base	STEEL RAILS Per Net Ton Standard	Light	Re-rolled	TRACK SUPPLIES Angle Bars	Std Spikes *c*	Tie Plates *c*	Track Bolts
Birmingham	$2.35	$2.35	$3.75	$3.25	....	$43.39	$49.18	$48.29	$2.70	$3.65	$2.55	$4.75
Chicago	2.35	2.35	3.75	3.25	$2.65	43.39	49.18	48.29	2.85	3.65	2.55	4.75
Pittsburgh	2.35	2.35	3.75	3.25	2.65	43.39	49.18	48.29	2.85	3.65	2.55	4.75
Buffalo	2.35	2.35	....	....	2.65	.....	.....	.....	....	....	2.55	.....
Cleveland	....	2.35	3.75	3.25	....	.....	.....	.....	....	....	....	....
Youngstown	....	2.35	....	....	....	.....	.....	.....	....	3.65	....	....
Detroit	....	2.45‡	....	....	....	.....	.....	.....	....	....	....	....
Gulf ports	2.60*a*	2.70*a*	....	....	2.85*a*	.....	.....	.....	....	....	....	....
Pacific ports	3.00*a*	2.75*a*	....	3.75*a*	3.20*a*	.....	.....	.....	....	3.90	2.70	....

‡ Delivered *a* F.o.b.cars dock *b* Rail steel same as billet prices *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone. Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per ct.

IRON AND STEEL PRODUCTS—F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb base price	REINFORCING BARS *g* Per 100 lb., ¼ in., base price 15 tons or over *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH Per 100 sq. yd., carload lots Std. diamond mesh, 3.4 lb.	Std ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq ft., carload lots 4x16 in., No. 5 & 10 wires	4x12 in., No 8 & 12 wires	6x6 in. No 6 & 6 wires Per 100 s. f	SHEET PILING Per 100 lb. base price
Atlanta	$2.34	$2.40	$2.40	$.025	$.10	$21.06	$23.00	$1.82	$1.35	$1.91	$3.04
Baltimore	3.95	3.15	3.00	....	.10	24.00	26.00	1.70	1.27	1.79	3.25
Birmingham	2.35*a*	2.15	2.15	.025	.10	19.00	21.00	1.80	1.34	1.89	....
Boston	4.162‡	4.194‡	....	$20 C.L.	.10	18.50	20.50	1.76	1.31	1.84	3.02
Chicago	2.35*a*	2.35*a*	2.35*a*	.03	.05	21.50‡	23.50	1.67	1.25	1.75	2.65
Cincinnati	3.93	2.86*cd*	2.86*cd*	....	.05	19.50	21.50	1.66	1.25	1.74	....
Cleveland	3.838	3.30	3.30	.025	.10	20.50	24.50	1.66	1.25	1.74	....
Dallas	4.25	3.17	3.17	....	....	25.50	27.50	1.93	1.42	2.03	....
Denver	4.827	4.60	4.50	....	....	28.00	30.50	1.97	1.45	2.07	....
Detroit	3.911‡	2.70‡	2.70‡	....	.10	25.00	30.00	1.68	1.26	1.76	2.91
Kansas City	4.44	2.75*cd*	2.75*cd*	.0	.05	25.50	27.50	1.78	1.33	1.87	3.062
Los Angeles	4.45*f*	3.025	2.487	.025	.05	23.00	27.50	1.93	1.42	2.03	4.45
Minneapolis	4.122‡	2.99	2.99	.0	.10	21.00	23.00	1.80	1.34	1.89	3.044
Montreal	3.95*i*	2.90*i*	2.80*i*	....	....	31.00*hi*	46.00*hi*	2.76	3.44*i*	2.82*im*	....
New Orleans	4.408‡	3.84	4.108	.05	.10	22.00	24.00	1.82	1.35	1.91	3.125
New York	4.008	2.96*c*	2.96*c*	....	.15	17.50	19.50	1.72	1.29	1.81	2.74
Philadelphia	3.916	3.868	....	....	....	20.50‡	22.50‡	1.71	1.28	1.79	2.97
Pittsburgh	2.35*a*	2.35*a*	2.35*a*	.025	.10	23.00	26.50	1.59	1.20	1.67	2.65
St. Louis	3.697	2.94	2.94	.0	.05	28.00	34.00	1.69	1.27	1.78	2.70
San Francisco	4.60	3.025	2.875	.025	.10	21.00	24.50	1.93	1.42	2.03	3.20
Seattle	3.00*e*	3.00*e*	....	....	....	34.50	38.50	1.93	1.42	2.03	3.20*e*

‡ Delivered *a* Mill prices. *b* 5–15 tons, add 15c 1–5 tons, add 25c Less than 1 ton, add 50c *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. dock. *f* Includes delivery in free delivery zone. *g* High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills *h* List price. *i* Plus Dominion and Province sales tax. *m* Per sq. yd.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE Per foot, std 8 in., s.s.	Delivered std 12 in., s.s.	ASTM 24 in.	C13-35 36 in.	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in	8 in	CONCRETE SEWER PIPE Per ft., delivered; ASTM 12 in.	C 14-35 24 in.	WROUGHT STEEL PIPE Full standard weight, *h* 1 to 3 in., Butt Weld Black %	Galv %	3½ to 6 in., Lap Weld Black %	Galv %
Atlanta	$58.40	$0.43	$0.67	$3.39	....	$110.00	$140.00	$0.45	$2.00	48.2	54.2	59.7	51.2
Baltimore	62.80	.35	.60	2.70	$7.25	160.00	200.00	.75	2.00	65.5	57.5	63.0	54.5
Birmingham	54.00	.275	.495	1.95	5.50	100.00	220.00	.50	1.75	62.2	54.2	59.7	51.2
Boston	65.00	.392*r*	.756*r*	3.15*r*	7.995*r*	170.00‡*r*	265.00‡*r*	.46*l*	1.77*l*	....	....	....	....
Chicago	62.80	.40	.675	2.70	7.00	110.00‡	150.00‡	.45	1.85	63.0	52.0	61.5	50.0
Cincinnati	61.80	.308	.594	3.42	8.20	97.30	149.40	.36	1.60	51.5	39.4	51.4	36.0
Cleveland	63.20	.266*r*	.513	2.15	5.535	138.50	216.60	.36	1.60	68.5	57.5	66.0	54.5
Dallas	64.78	.365	.657	2.664	6.00	108.00	130.00	.46	1.57	....	....	....	....
Denver	69.62	.32	.576	2.376	....	143.00‡	264.00‡	.52	2.00	40.5*s*	27.5*s*	36.5*s*	22.5*s*
Detroit	63.20	.42	.81	3.15	8.50	170.00‡*r*	263.00‡*r*	.36	1.60	54.1	40.3	50.9	36.5
Kansas City	64.12	.35	.59	2.20	6.20	160.00	286.00	.45	1.60	....	....	....	....
Los Angeles	76.00	.325†	.585†	2.70	6.75	130.50	217.50	1.00†	2.00†	60.6	49.6	57.9	46.4
Minneapolis	66.10	.305†	.549†	2.196†	6.25†	....	....	.90	2.40	60.6	49.6	57.9	46.4
Montreal	67.00	.85*o*	1.50*o*	5.25*p*	8.50*ep*	45.00*m*	64.00*m*	.811*m*	2.51*m*	....	....	....	....
New Orleans	60.49	....	....	....	....	....	....	....	....	....	....	....	....
New York	62.20	.38	.75	3.06	7.88	....	....	.60	1.40	61.9	50.9	59.4	47.9
Philadelphia	60.90	.385	.75	3.06	8.00	180.00	250.00	.45	1.75	52.75	39.01	49.63	35.25
Pittsburgh	63.60	.287†*r*	.5535†*r*	2.475†*r*	6.4575*r*	124.20	193.80	.99	2.25*g*	68.5*s*	57.5*s*	66.0*s*	54.5*s*
St. Louis	61.40	.31*w*	.558*w*	2.232*w*	4.95*w*	93.50*w*	187.00*w*	1.00*j*	2.15*k*	64.5*s*	53.5*s*	63.0*t*	51.5*t*
San Francisco	76.00	.3875*d*	.6975*d*	2.79	6.975	124.50	207.50	.58	2.34	....	....	....	....
Seattle	77.80	.4125	.77	2.98	....	115.20	....	.51*f*	1.44*f*	....	....	....	....

‡ Delivered † F.o.b *a* B. & S. class B and heavier, C/L lots. Burlington, N. J. (base) $59.00. Based on existing freight rates; subject to rate change. Gas pipe and class A. $3 per ton additional, 4 in., $5 per ton additional, 30 in. and larger usually $1 per ton less. *b* Double strength. *d* List. *e* 30-inch. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard list consumers carload prices, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.: ½ in. 8½c.; ¾ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 per cent tax on transportation costs not included. *i* Applies also at Lorain, Ohio mills. Chicago delivered base is 2½ points less on butt. 1½ on lap. Freight is figured from Pittsburgh, Lorain, O., Chicago Dist. Billing is from point producing lowest price at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base Butt-weld—1 in. and 1¼ in. black 34 galv 16; 1½ in. black 38 galv 18½; 2 in. black 37½, galv. 18. Lapweld—2½ in. to 3½ in. black 31½ galv. 14½; 4½ in.; to 8 in. black, 32½ galv. 17 *j* Reinforced; spec. C 76-37 *k* Reinforced; spec. C 75-37. *m* Centri. spun *o* Less 50%. *p* Less 53%. *r* Truck delivery. *s* Gary base *t* Lorain base. *w* Less 3% for cash

Engineered EQUIPMENT for WATER and SEWAGE PLANTS

Over the years Simplex users have continued to show their preference for Simplex on performance.

Simplex Users STAY *Simplex Users . . .*

SIMPLEX Equipment for
Water and Sewage Treatment Plants

Meter Registers . . . Rate of Flow Controllers . . . Loss of Head and Rate of Flow Gauges . . . Elevation Gauges . . . Sand Expansion Indicators . . . Pilot Equipment . . . Air Release Valves . . . Air and Vacuum Valves . . . Venturi Tubes and Other Primary Devices . . . Hydraulic Equipment of Special Design . . .

SIMPLEX VALVE & METER COMPANY
6751 UPLAND STREET, PHILADELPHIA 42, PENNA.

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face) (Prices in italics)									LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight increment (See note for base price	
	All Fir planks No.2 common, Fir timber is No. 1 common. Lengths up to 20 ft.												
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 R2L	6x12 R2L	12x12 R2L	2x12 R2L	12x12 R2L	¼"	⅜"
Atlanta	**$41.00**	**$41.00**	**$35.50**	**$38.50**	**$37.50**	**$41.50**	**$45.00**	.....	.....	**$60.50**	**$64.00**	**$17.90**	**$21.85**
		35.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Baltimore	**48.00**	**50.00**	**48.00**	**50.00**	**51.00**	**56.00**	**70.00**	.....	.....	**125.00**	**130.00**	**18.25**	**22.25**
	52.00	*53.00*	*59.00*	*59.00*	*59.00*	*62.50*	*75.00*	*$80.00*	*$80.00*	.....	.....	.....	.....
Birmingham	**50.00**	**50.00**	**49.50**	**48.50**	**49.50**	**52.50**	**73.00**	.....	.....	.....	.....	**17.35**	**21.15**
[3]	55.00	55.00	54.50	53.50	54.50	57.50	77.00	60.00	61.00	72.50	75.00	.....	.....
Boston	**60.00[3]**	**60.00[3]**	**60.00[3]**	**60.00[3]**	**60.00[3]**	**62.00[3]**	**66.00[3]**	.....	.....	.....	.....	**18.25**	**22.25**
	55.00	*55.00*	*54.00*	*54.00*	*54.00*	*54.00*	*58.00*	*58.00*	*58.00*	*58.00*	*58.00*	.....	.....
Chicago ‡	**65.00**	**66.00**	**62.00**	**62.00**	**62.00**	**69.00**	**75.00**	.....	.....	**97.00**	**97.00**	**14.60**	**17.80**
	60.00	*60.00*	*61.00*	*61.00*	*61.00*	*62.00*	*63.00*	*63.00*	*64.00*	.....	.....	.....	.....
Cincinnati	**47.50**	**49.00**	**42.50**	**42.50**	**44.50**	**52.50**	**67.00**	.....	.....	**65.00**	**65.00**	**17.35**	**21.15**
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	**17.75**	**21.60**
Dallas	**45.25**	**45.25**	**44.50**	**43.00**	**43.00**	**47.25**	**60.75**	**58.75**	**58.75**	**88.75**	**85.00**	**14.60**	**17.80**
Denver ‡	**64.25[4]**	**64.25[4]**	**64.75[4]**	**65.25[4]**	**63.75[4]**	**64.75[4]**	**68.75[4]**	*72.00*	*72.25*	.....	.....	**10.45**	**12.70**
Detroit	**62.00**	**62.00**	**58.75**	**58.75**	**58.75**	**64.75**	**71.00**	.....	.....	**70.75**	**90.00**	**17.35**	**21.15**
	58.00	*58.00*	*58.00*	*58.00*	*62.75*	*72.75*	*75.00*	*75.00*	*90.00*	.....	.....	.....	.....
Kansas City a	**74.00**	**74.00**	**72.00**	**70.50**	**72.00**	**74.00**	**89.00**	.....	.....	**89.00**	**99.00**	**12.60**	**15.40**
	71.00	*71.00*	*64.50*	*64.50*	*64.50*	*64.50*	*80.00*	*85.00*	*85.00*	.....	.....	.....	.....
Los Angeles a	*60.00*	*60.00*	*60.50*	*60.75*	*59.25*	*59.25*	*72.75*	*72.00*	*72.00*	.....	.....	*9.90h*	*12.05h*
Minneapolis ‡b	**78.50[3]**	**77.25[7]**	.....	.....	.....	.....	.....	.....	.....	.....	.....	**12.60**	**15.40**
‡	*76.50*	*76.50*	*72.25*	*72.50*	*71.25*	*73.00*	*72.00*	*76.00*	*76.25*	.....	.....	.....	.....
Montreal e	**69.00**	**70.00**	**64.00**	**68.00**	**70.00**	**75.00**	.....	.....	.....	.....	.....	.....	.....
	97.00	*97.00*	*97.00*	*97.00*	*97.00*	*97.00*	.....	*87.00*	.....	.....	.....	.....	.....
New Orleans	**42.00**	**42.00**	**39.00**	**38.50**	**34.00**	**42.00**	**46.00**	.....	.....	**54.50**	**69.00**	**14.60**	**17.80**
	30.50	*30.50*	*30.00*	*30.00*	*29.00*	*29.00*	*28.50*	*29.50*	*29.50*	.....	.....	.....	.....
New York ‡	Range from $85.00 to $95.00						**$95 to $100**	.....	.....	**125.00f**	**130.00f**	**18.35**	**22.25**
‡	Range from *$85* to *$115*									.....	.....	.....	.....
Philadelphia	**75.00**	**75.00**	**75.00**	**75.00**	**75.00**	**75.00**	**75.00**	.....	.....	**130.00**	**130.00**	**18.25**	**22.25**
	75.00	*75.00*	*75.00*	*75.00*	*75.00*	*75.00*	*85.00*	*90.00*	*90.00*	.....	.....	.....	.....
Pittsburgh	**50.80**	**53.20**	**62.75**	**55.00**	**60.85**	**62.50**	**76.25**	.....	.....	**120.00**	**130.00**	**18.10**	**22.05**
	69.00	*68.10*	*66.10*	*65.30*	*65.20*	*65.75*	*82.75*	*88.75*	*88.75*	.....	.....	.....	.....
St. Louis	**62.25**	**62.25**	**61.25**	**60.00**	**60.95**	**63.00**	**74.25**	*69.75*	*68.25*	.....	.....	**14.60**	**17.80**
San Francisco d	*33.00*	*33.00*	*32.50*	*32.50*	*31.50*	*31.50*	*30.00*	*29.50*	*28.50*	.....	.....	**7.30g**	**8.90g**
Seattle	*50.00a*	*50.00a*	*52.25a*	*52.25a*	*51.00a*	*51.00a*	*50.75a*	*52.75a*	*57.75a*	.....	.....	**0.00**	**0.00**

Bold Face type. Southern Pine *Italics, Douglas Fir* [1]Long leaf [2]Roofers N. C. Pine [3]Spruce [4]Native [5]Western Pine, No 3 Common [7]Spruce [8]Norway Pine ‡ Delivered. *a* Yard prices. *c* 5M ft. or less *d* F.o.b. cars San Francisco freight rate *e* Plus sales tax *f* Up to 18 ft. *g* Lower rate by water shipment *h* 50,000 lb minimum

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ¼" $95.15; on ¾", $104.85; price includes oiling and sealing charges. For other centers add rail freight increment from table or proper size. For resin dipped treatment, add $10.50 per M

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Aug 15, 1938, Single or Double Thickness		EXPLOSIVES — Per lb 40% Ammonia Gelatin in 50-lb cases delivered in 200 lb. lots*
	A quality	B quality	
Atlanta	74%	75%	$0.15
Baltimore	78%	79%	.15
Birmingham	76%	76%	.105
Boston	77%	78%	.15
Chicago	77%	77%	.15
Cincinnati	77-10%	77-10%	.15
Cleveland	77%	77%	.19
Dallas	76%	76%	.1575
Denver	76%	76%	.155e
Detroit	77%	77%	.1575
Kansas City	77-10%	77-10%	.155
Los Angeles	86%d	88%d	.1575
Minneapolis	77%	77%	.15
Montreal	40-10-2%ab	50-2%ac	.1675†
New Orleans	70%	75%	.16
New York	80%	81%	.22f
Philadelphia	78%	79%	.15
Pittsburgh	79%	79%	.1225
St. Louis	77-10%	77-10%	.155
San Francisco	66%	73%	.155
Seattle	75%	75%	.1575†

Price of 60% Ammonia Gelatin is $0.01 per lb higher than 40%

a Discount from list Sept. 1939: sales tax included, but 6% tax exemption not allowed for *b* Single thickness *c* Double thickness *d* Discount from jobbers list Sept. 15, 1928.

* Urban prices influenced by service charges or local storage and delivery regulations, do not consistently reflect quantity prices in less congested areas. *e* F.o.b. Louviers, Colo. *f* In boroughs of Kings, Queens and Richmond, and in Manhattan south of Canal St. add delivery charge of $6.00 per trip †F.o.b.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb net	Tons	200 lb. lots
E. of the Miss., except Fla and Me	$0.105	$0.13	$0.15
W. of Miss. to Rocky Mtn. States, Fla and Maine	.11 -.1175	.135 -.1175	.155 -.1675
Rocky Mtn. States	.11 -.1225	.135 -.1525‡	.155 - 1725‡
Pacific N W States	.1075-.12	.1375-.15	.1575-.17
Pacific S W States	.1050-.1125	.135 -.1425	.155 -.1625

‡ F.o.b. Louviers, Colo., or Butte, Mont.

PILES, TIES F.O.B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk

Dimensions	Points	Length	By Rail — Pine *	By Rail — Fir
12-in at butt	6-in	30 to 50-ft.	$0.34	.....
12 in — 2 ft from butt	6-in	50 to 59-ft.	.35	.....
12-in — 2 ft from butt	6-in	60 to 69-ft.	.36	.....
12-in — 2 ft from butt	6-in	90 to 100-ft.	...	.54
13-in — 3-ft from butt	5-in	91 to 100-ft.	...	.56
14-in — 2-ft from butt	6-in	50 to 69-ft.	.41	.63
14-in — 2-ft from butt	6-in	70 to 79-ft.	.43	.57
14-in — 2-ft from butt	5-in	80 to 85-ft.	.54	.....
14-in — 2-ft from butt	5-in	85 to 89-ft.	.57	.....
14-in — 2-ft from butt	5-in	90 to 100-ft.	...	.62

* Pine piling over 80-ft available only in limited quantities.

RAILWAY TIES

Prices f.o.b. per tie for carload lots:		6"x8"x8' Untr	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.50	....	$2.00	....
	Pine	2.00	$3.00a	2.50	$3.00a
New York	S. L. Sap Pine	1.43/1.54	2.59	1.76	2.86
	Mixed Oak	1.71	2.59	2.42	3.58
Birmingham	Hardwood	1.00	1.60a	....	2.25a
Chicago	Red Oak	....	2.45/2.65a	....	3.35/3.60
Los Angeles	Douglas Fir	2.00	3.25a	2.90	4.70a
Philadelphia	Red Oak	....	2.10ag	....	3.25ag
St. Louis	White Oak	1.70	....	2.40	....
	Red Oak	1.63	2.15a	2.19	3.25a
	Sap Pine or Cypress	1.70	....	2.06	....
San Francisco	Douglas Fir	1.25bef	....	....	3.00aw
Montreal	Birch or Maple	....	1.65	1.04	....

Tr — Treated: Untr — Untreated *a* Creosoted *b* 6"x8"x8'6" *c* Empty cell *d* Zinc *e* Green *f* F.o.b. cars † Out of market *g* January 1943 price, none later available

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder, in drums, f.o.b. works, per 100-lb	$2.50- 3.10
Chlorine cylinders, liquid, per lb., delivered	.0525
Calcium chloride, 77-80% flaked, 100-lb paper bag, del'd, ton	18.50-35.00
Silicate of soda, 52 deg. in drums, f.o.b. works, per 100 lb	1.40
Soda ash, 58%, in paper bags, per 100 lb, dense	1.15
Sulphate of aluminum, commercial, in 100-lb. bags, per ton	23.00-25.00
Sulphate of copper, in bbl., per 100-lb	5.00

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME — DELIVERED

	STRUCTURAL CLAY TILE PARTITION — SCORED Per M lots of 2,000 pieces or over.			STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M lots of 2,000 pieces or over			BRICK Per M in quantity		LIME		
	3x12x12 in.	4x12x12 in	8x12x12 in.	8x12x12 in	10x12x12 in	12x12x12 in	Common backing	Straight hard	Per ton, Hydrated finishing	In paper Common hydrated	Carload lot, Pulverized, or lump
Atlanta	$110.00	$130.00	$230.00	$240.00	$270.00	$300.00	24.00	$24.00	$19.00	$17.50	17.50
Baltimore	90.00	95.00	175.00	200.00	260.00	300.00	17.00k	21.00k	20.00	15.00	2.50m
Birmingham	80.00	85.00	160.00	191.00	252.00	288.00	18.50	23.00	18.11	14.05	15.05—18.95
Boston	105.00†	112.00†	210.10†	252.09†	.....	.....	20.00i	20.00i	21.00†	.....	16.00
Chicago	85.80	91.70	172.60	x	x	x	17.00	18.00	17.00	15.00	12.50
Cincinnati	65.55	69.90	131.20	148.70	210.35	240.45	27.75	27.75	15.50	13.00	.....
Cleveland	98.10	104.56	x	.....	.....	.....	22.75	22.75	15.75	13.25	.....
Dallas	77.25	83.00	165.00	198.00	254.50	315.00	17.25	19.00	19.00	15.00	15.00
Denver	99.00	112.00	185.00	214.00	248.00	294.00	21.50	.....	30.00j	24.00j	26.00
Detroit	92.70	96.70	174.50	198.80	257.20	294.30e	23.25f	23.25f	20.00	18.00	18.00
Kansas City	67.00	69.00	89.00c	128.00	163.00	189.00	17.50	18.50	19.32	13.00	10.92
Los Angeles	80.00†r	95.00†r	132.00c†r	210.00†r	368.00†r	460.00†r	14.50	16.00	16.50	17.50	17.50
Minneapolis	.....	112.00b	186.25b	112.00cc	.....	.....	18.50s	.....g	24.00	16.00	19.00
Montreal	92.50u	98.50u	196.25u	151.50u	100.50ut	134.50uc	22.16†u	33.20†u	24.60u	15.00u	14.00u
New Orleans	104.59	109.55	207.25	222.25	326.90	385.65	17.75	.....	18.30	12.08	14.10
New York	99.40z	106.00z	145.75c z	156.60hn	x	x	23.00	.....	20.00	14.00	17.00
Philadelphia	112.10	119.60	224.20	269.10	321.20	405.10	20.75	23.75	22.00	18.00	17.00
Pittsburgh	88.40	94.30	176.85	212.30	260.85	298.10	23.25	25.25y	17.90	15.40	2.55m
St Louis	67.00	72.00	130.00	190.00	244.00	290.00†	23.50s	22.50s	22.00s	18.00s	x
San Francisco	96.00	108.00	144.00	108.00t	.....	.....	21.00	.....	18.50	18.50	1.85m
Seattle	121.00	133.00	x	133.00cc	.....	.....	22.50k	27.75k	20.00s	20.00s	3.00m

† F.o.b. a Smooth. b Carload lots delivered to job. c 6x12x12 in., 3-cell. cc 5 x8x12. e 48 lb. tile. f Includes $3.50 per M. for delivery. g No quotation. h F.o.b. Perth Amboy N. J. i F.o.b. Warehouse only. j OPA Price k $1.00 discount. m Per bbl., 180 lb n 7⅝ x 7⅝ x 12 Speed tile. o Per bbl., 200 lb r 5% discount 10 days. s 2% discount for cash. t 5½ x 8 x 11½. u 8% sales tax included. v sand lime. x Not available. y Stacked z Subject to 20—25% increase.

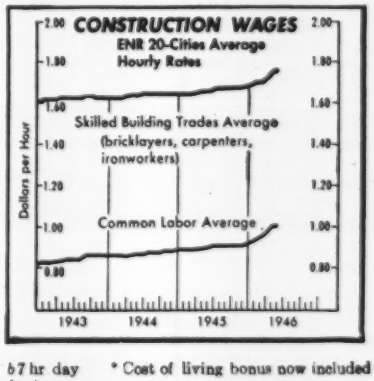
PAINT, ROOFING — F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry a	WHITE LEAD Per 100 lb. in oil	READY-MIXED PAINT Per gal., drums Graphite b	Aluminum c	Ferric Oxide d	ROOFING SUPPLIES Carload lots f.o.b., factory Rolls, slate surfaced, 85-90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal	Tar pitch 360 lb. bbl. per ton
Atlanta	$10.25	$14.125	$1.30	$2.25	$1.20	$2.06	$2.06	$2.06	$1.00	$36.00
Baltimore	10.00	13.75	2.00	3.00	2.50	2.30	2.70	2.70	.40	29.00
Birmingham	10.25	14.125	2.25	3.53	1.98	2.09	1.98	1.98	.32	28.35
Boston	10.00	13.75	1.75	2.50	2.31	2.00‡h	3.30‡us	3.30‡us	.25‡	21.00‡
Chicago	10.00	13.75	....	....	....	1.75hf	1.74hf	1.82hf	.33f	23.00f
Cincinnati	10.00	13.75	1.70	2.905	1.60	2.20	2.10h	2.10h	.33	25.00
Cleveland	10.00	13.75	1.70	2.90	1.60	1.71	1.63h	1.61h	.237	25.00
Dallas	10.00	14.50	1.88	2.11n	.05l	1.75h	1.66h	1.66h	.35	39.00
Denver	10.00	14.25	1.80	13.2k	16.15k	3.00	1.92h	1.92h	.29	29.00
Detroit	10.00	13.75	1.75	3.00	1.60	2.25	2.25	2.25	.50	23.00
Kansas City	10.00	13.875	2.30g	2.55g	2.16g	2.19	2.30	2.30	.28	27.50
Los Angeles	10.25	14.25	1.60	2.25	2.30	2.10	1.50	....	.45	.....
Minneapolis	10.00	13.875	....	....	....	1.7123s	1.6243hs	1.6243hs	.32	23.00
Montreal	.....	11.05	2.50p	4.90p	3.15p	2.71	2.45t	2.45t	.84t	1.83hl
New York	10.00	13.75	2.03	....	1.82	1.7098	1.6273o	1.6273o	.26	23.00
Philadelphia	10.00	13.75	1.60/1.80	2.20	1.55	2.25	2.71	2.71	.32	23.00
Pittsburgh	10.00	13.75	1.05	1.90	1.10	1.95	1.84h	1.84h	.34	26.00
St. Louis	10.00	13.75	2.28s	2.89s	1.96s	1.71h	1.70h	1.70h	.38	22.00
San Francisco	10.25	14.00	1.80	2.75n	1.35	1.71	2.40	2.40	.33	20.50
Seattle	10.25	14.25	1.90	3.00	....	2.15	2.16h	....	.35	31.00j

‡ Delivered Note: Red lead in oil 50c higher than white lead in oil a Red lead prices change frequently due to pig lead price changes b U. S. War Dept. Spec. 3-49A c ASTM Spec D266-31. d 80% minimum ferric oxide f Distributors' price to contractors g 55 gal. can h Per roll. 65 lb. i Minneapolis and vicinity j Asphalt pitch k Per 100 lb l Per lb. n May, 1941 price o 60-lb roll p Plus 8% sales tax s December, 1942 price t Federal tax included u 90-lb roll. v Truck delivery

SKILLED AND COMMON WAGE RATES — PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Common Labor Heavy Const.
Atlanta	$1.75	$1.50	$1.625	$1.50	$1.50	$0.65	$0.80
Baltimore	1.90	1.675	1.90	1.625/2.00	1.725	.95	.95
Birmingham	1.9375	1.375	1.625	1.50	1.65	.65	.65
Boston	1.725	1.60	1.725	1.65	1.667	1.15	1.15
Chicago	1.90	1.85	1.88	1.85	1.90	1.20	1.20
Cincinnati	1.875	1.65	1.775	1.875/2.125	1.875	.95	.95
Cleveland	2.00	1.65	2.00	2.00	2.00	1.25	1.25
Dallas	1.937	1.425	1.625	1.625	1.75	.80	.80/1.25
Denver	1.80b	1.625	1.50b	1.625b	1.90	1.00	1.00
Detroit	1.90	1.625	1.825	1.675/1.825	1.90	1.15	1.15
Kansas City	1.75	1.575	1.70	1.70	1.75	.975	.90
Los Angeles	1.50	1.50	1.75	1.50	1.75	1.25	1.25
Minneapolis	1.825	1.50	1.75	1.60	1.725	1.01	1.01
New Orleans	1.625	1.375	1.625	1.55	1.50	.70	.80
New York	2.25b	2.10b	2.25	2.25b	2.00/2.25b	1.25	1.20
Philadelphia	2.00	1.775	1.90/2.00	2.25	2.00	1.025	1.025
Pittsburgh	2.00	1.75	1.75	1.8125	1.875	1.00	.90
St. Louis	2.00	1.95	2.00	2.20	1.90	1.00	1.00
San Francisco	2.05	1.75	1.75	1.60/2.00	2.00	1.0625	1.0625
Seattle	1.91	1.61	1.81	1.90	1.91	1.21	1.21
Montreal*	1.06	.96	1.01	1.01	1.06	.61	.66



b 7 hr day * Cost of living bonus now included in basic wage

ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $1.772

ENR Common Average: $1.018

New Aids to the Constructor

MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

Nickel-Lined Pipe

Said to provide long-lasting corrosion protection at a fraction of the cost of pipe made entirely of corrosion resistant materials, a new process electrolytically deposits a predetermined thickness of nickel on the inside surface of pipe, tubing and fittings. A complete line of "Bart Lectro-Clad" fittings and pipeline accessories, as well as pipe and tubing, is available in sizes up to and including 24-in. dia.—*Bart Manufacturing Co., Inc., Belleville 9, N. J.*

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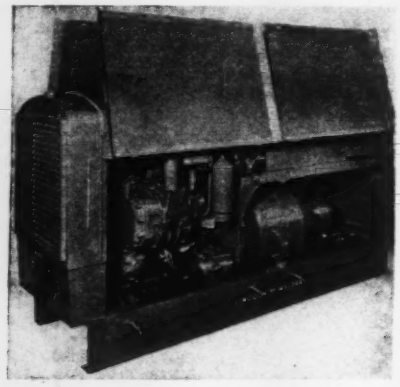


Diesel-driven Welder

A new diesel engine-driven welder of 300-ampere capacity, specially made for use in locations where electric power is not available or economical, is announced.

Powered by a 2-cycle diesel engine, this welder is said to cut fuel costs up to 86 percent, depending upon the price of fuel oil used. In some cases total savings, including transportation of fuel, are reported as high as 40¢ per hour.

This power unit makes available an engine of simple, rugged design assuring low first cost, light weight, high efficiency and great service economy. The engine is a compact unit.—*The Lincoln Electric Co., Cleveland 1, Ohio.*

• • •

Heavy-Duty Dollies

Obtainable in pairs, the new Skid-Rol dollies will carry 10 to 12 ton loads. Sturdy steel cleats imbedded into the wood skids carry the load only a few inches from the floor. Each dolly measures 18½ x 10½ x 4 in. and is equipped with four 3¾ in. dia. all-steel rollers.

These dollies can be rolled over all types of hard floor or diagonally across railroad tracks. They can also act as a turntable, or, if inverted, as a standing dolly for moving steel beams, girders, etc.—*Techtmann Industries, Inc., 828 North Broadway, Milwaukee 2, Wis.*

• • •

Aluminum Axle

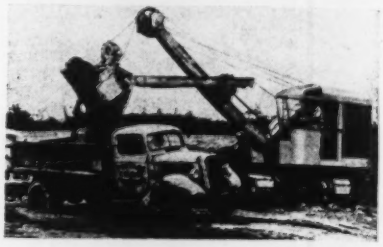
A light-weight, heavy-duty truck axle with aluminum housing, hubs and brake shoes, called the "S-200-P", is said to be the first aluminum axle offered as standard equipment. This rear axle, allowing over 18,000 lb. per axle at the tires on the ground, has two interchangeable types of final drive—hypoid-helical double reduction and two-speed hypoid-helical double reduction.

The "S-200-P" weighs 220 lb. less than the same unit with malleable iron parts, which should lengthen tire life and improve the truck's riding qualities.—*Timken-Detroit Axle Co., Detroit, Mich.*

• • •

Excavator

Byers Model 61, a half-yard excavator on crawler mounting, is the second new shovel and crane announced by this company recently. The model embodies many of the same design features as the "Traveler," including full ½ yd. capacity, Airflex fingertip air clutches, gears



enclosed and running in forced circulating oil, wide and large tandem drums and new patented worm type boom hoist.

The crawler base of Model 61 is 10 ft. 8 in. long and 8 ft. wide and the new 18-in. treads are self-cleaning, non-clogging and roller chain driven.—*The Byers Machine Co., Ravenna, Ohio.*

• • •

10-Ton Crane

Features of a new crane are that it has a mobile full-swing boom, is tractor mounted and easily driven where needed. Booms of standard lengths from 15 to 30 ft. are furnished; they will handle loads of nearly 2 tons at a 30-ft. radius. 10 tons at 9 ft. Ball-bearing boom

New Type of Truck

A twin-engine truck especially designed for fast long distance hauling has been developed. Through special arrangement of wheels using 16 heavy duty tires, it has a payload capacity of 20 tons. A new feature is four front steering wheels in tandem rather than dual relation. Power steering is not needed.

The truck has three rear axles, including two driving or "live" axles, with a "dead" axle between. It is pointed out that great traction is achieved because of remote spacing of the live axles.

There are two standard-make 93-hp. motors mounted in line. They can be used together or independently.—*Eisenhauer Manufacturing Company, Van Wert, Ohio.*

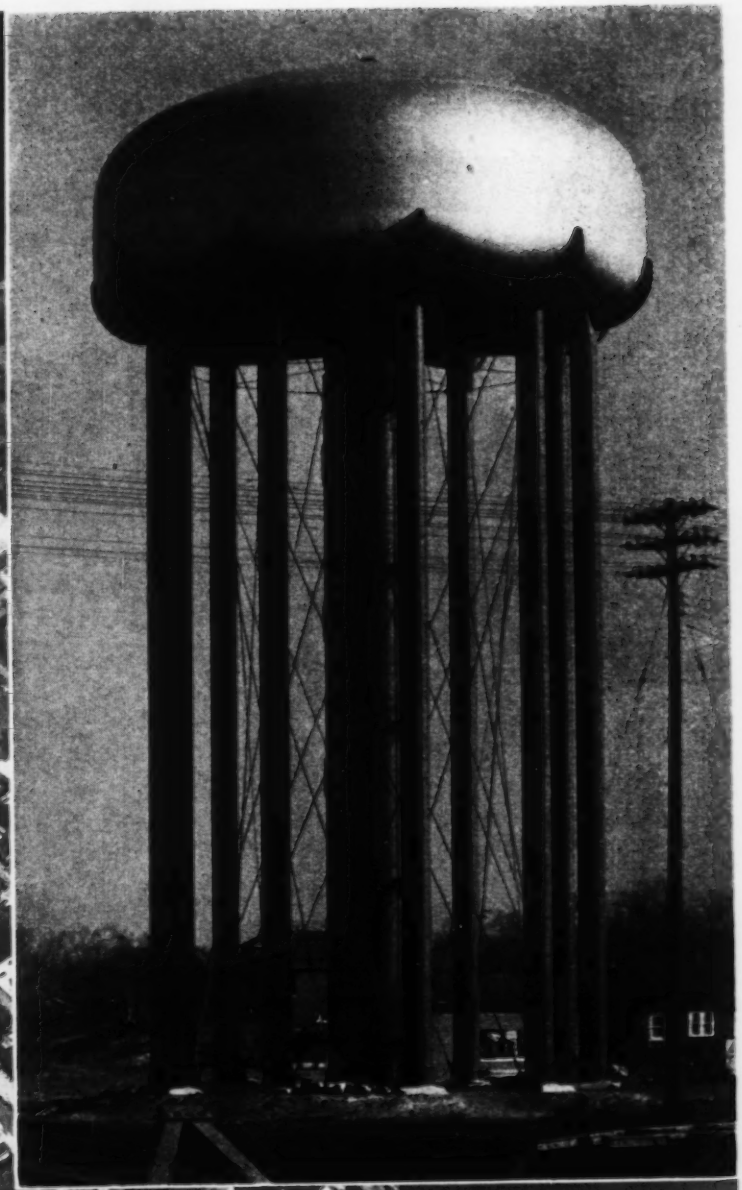
you live in Gary
RIGHT SIDE
of Broadway

With a total of [illegible] gals. of elevated storage in the system, pressures have been increased materially throughout all sections, including the outlying districts. Furthermore, the pumps do not need to supply the entire peak load. They can be operated to meet average needs, which increases their efficiency as well as extends their useful life.

The Gary system serves over 17,000 meters in an area of 44 sq. mi. by means of 180 mi. of mains. The average daily consumption during the summer months is 26,000,000 gals. This is a big job and the Northern Indiana Public Service Company has found that they can do it better—and more economically—with adequate elevated storage at the right locations.

If you are making plans for water works improvements, write our nearest office for information or estimating figures.

State capacity, height to bottom, location and type of tank desired.

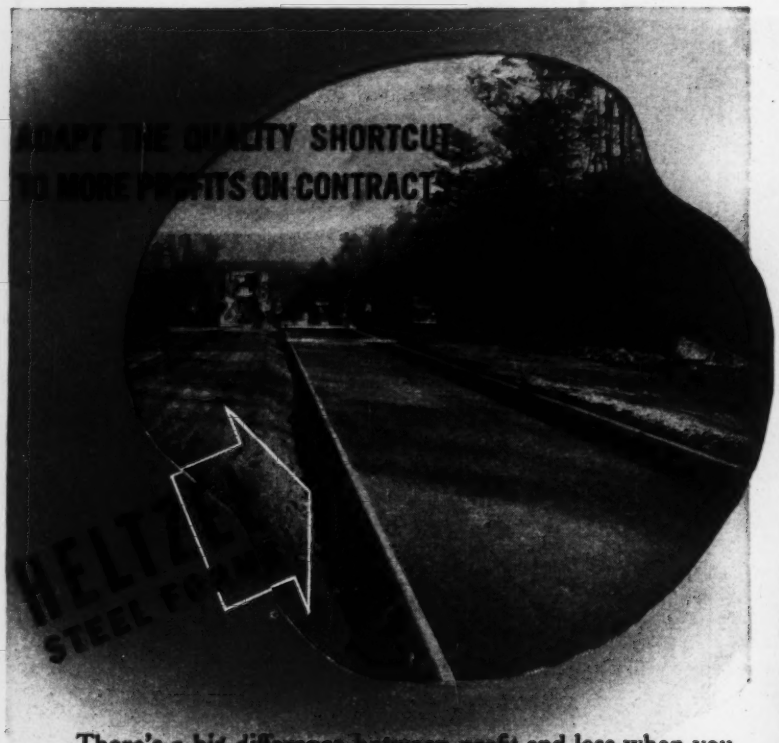


750,000-gal. radial-cone elevated water tank west of Broadway at 19th Street in the Gary, Ind., water system. It is also 105 ft. to bottom.

& IRON COMPANY

Birmingham 1....1838 North Fiftieth Street
Atlanta 3 .....2125 Hockey Bldg.
Wenatchee .....703 Atlantic Bldg.
Houston 1 .....5469 Clinton Drive
Los Angeles 14.....1411 Wm. Fox Bldg.
San Francisco 11...1220-22 Rookery St. Bldg.

In Canada—NORTON STEEL WORKS, LIMITED, PORT ELIN, ONT.



There's a big difference between profit and loss when you can strip, move in and get set for another job without costly reconditioning. You can do it easily and quickly with Heltzel Steel Forms... without fuss or fuming.

The value of your Heltzel Forms increases with each additional mile of completed paving. You'll cheer these lower maintenance and conditioning costs.

Vibration or jarring cannot bother Heltzel Forms... thanks to a non-clogging, single wedge stake pocket, one of the many exclusive Heltzel features.

Remember, Heltzel builds it better.

Place your order for Steel Forms now. If you delay, steel may not be available, and we will be unable to make delivery on time.

Profit Information Here

B-19 STANDARD ROAD FORMS | **B-19-A** DUAL ROAD FORMS | **A-20-F** STREET FORMS

Send for your copies; mailed promptly upon request

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BUILDS IT BETTER

BINS (Portable and Stationary)
CEMENT BINS, Portable and Stationary
CENTRAL MIXING PLANTS
BATCHERS (for paving mixers or truck mixers with automatic dial or beam scale)
BITUMINOUS PAVING FORMS
ROAD FORMS (with tie bars and integral curb attachments)
CURB FORMS
CURB AND GUTTER FORMS
SIDEWALK FORMS
SEWER AND TUNNEL FORMS
CONCRETE BUCKETS
SUBGRADE TESTERS
SUBGRADE PLANERS
TOOL BOXES
FINISHING TOOLS FOR CONCRETE ROADS

HELTZEL STEEL FORM & IRON CO.
WARREN, OHIO · U. S. A.

turntable and all gears and clutches run in oil, fully enclosed. Boom swing and hoist and load hoist are all independent actions, with separate controls and automatic brakes.

This crane is well adapted for loading, unloading, moving or stacking heavy bulky objects, especially outside the range of big overhead cranes or where none is available.—*The Hughes-Keenan Co., 649 Newman Street, Mansfield, Ohio.*

• • •

New Lubrication Principle

A leading feature of a new lubricator is a paddle-lock tamping blade which eliminates air pockets without the use of bleeder valves. This patented device

paddles and packs the grease as it pumps, assuring 100 percent delivery of uncontaminated lubricant into the fitting at all times and in all weathers. The 30-lb. capacity takes a full 25-lb. can of grease and pumps the container empty without a sputter.

The adapter, with a universal swivel as an integral part of the hose line, permits adapter change in seconds for button-head, hydraulic or pin-type fittings. —*Balcrank, Inc., Cincinnati 9, Ohio.*

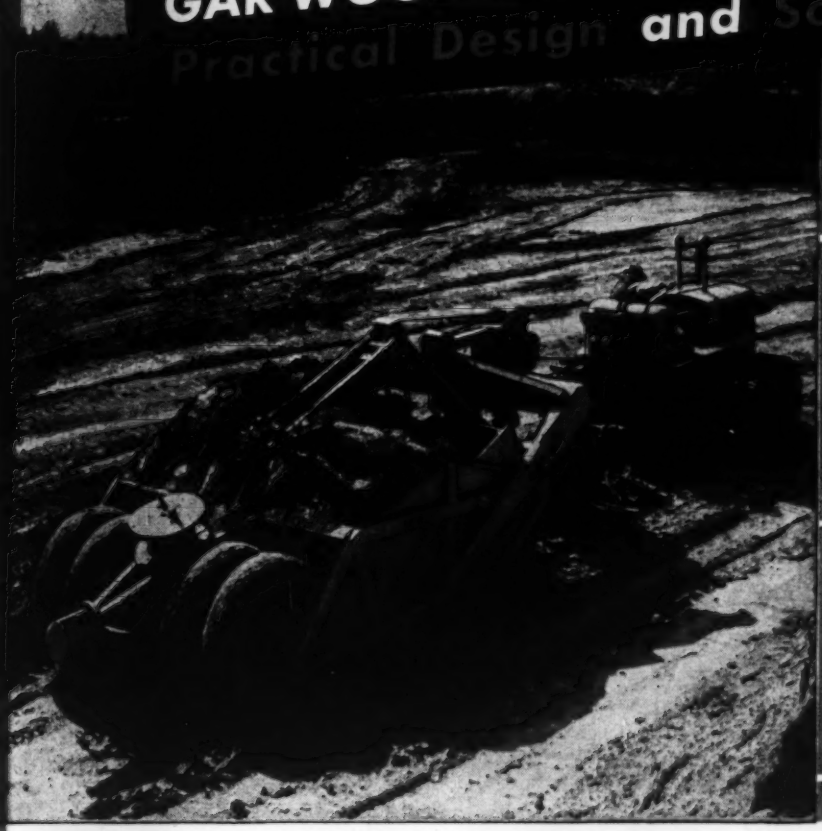
• • •

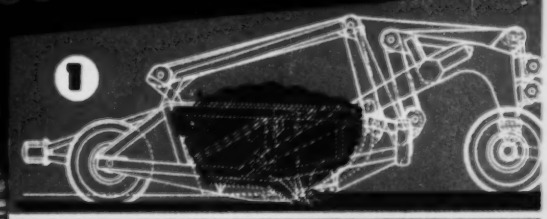
Track Maintenance

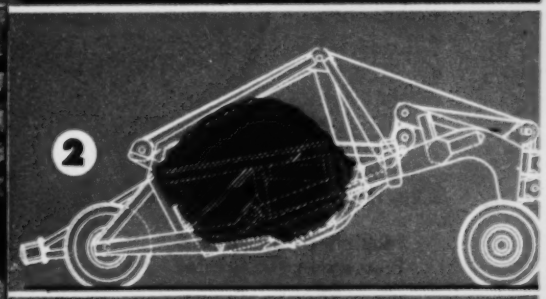
A track-walking "Wingdozer" consists of a crawler-type tractor equipped with "track walking shoes," a special type of

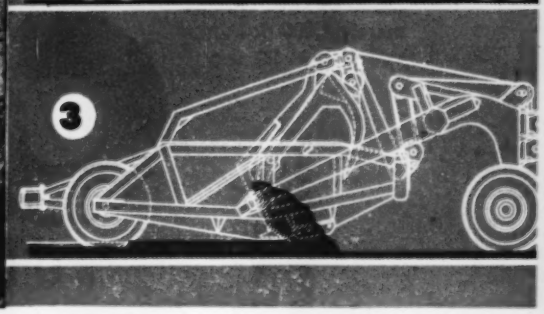
Down-to-Earth Engineering

GAR WOOD Earth Moving Equipment Features Practical Design and Sound Construction









GAR WOOD 4-Wheel Cable Scrapers are *all scraper*, well engineered, honestly built of high quality materials, developed and proved over a period of many years—scrapers that *hold together* and get big yardage jobs done at consistently good speed with an absolute minimum of down time. Some of the many outstanding engineering features, as well as the rugged simplicity of the mechanism, are shown in the three drawings above:

1. LOADING: The self-loading is by positive digging to depths down to 12". "Boiling" action of dirt loads bowl and patented apron evenly by reason of proper angle of the cutting edge. Positive digging action is assured in all types of materials by proper location of draft point.

2. CARRYING: This position provides extremely high clearance of cutting edge, essential in traveling over uneven ground and in discharging sticky materials. Proper weight distribution with exceptionally low center of gravity assures stability—provides for maximum tire life.

3. DUMPING AND SPREADING: The first portion of the load dumps automatically when the apron is raised. The remainder is forced out by *positive rolling ejection.* Note extremely large apron opening to facilitate this ejection of all types of materials. Cutting edge remains stationary throughout cycle, providing for even, *accurate control* of the spread by the heavy duty *Gar Wood Cable Control Unit.*

Contact your Allis-Chalmers dealer. He will be glad to show you Gar Wood earth moving equipment and arrange for you to see on-the-job performance in your locality.

Heavy Duty Rippers | Hydraulic Dozscator | Cable Dozscator | 2-Wheel Hydraulic Scrapers

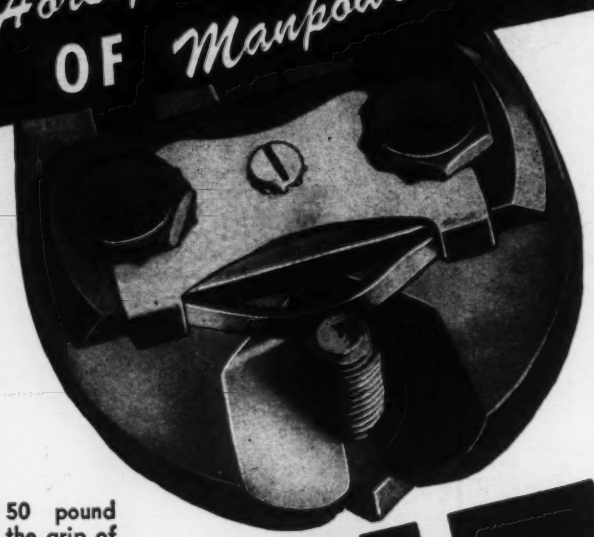
OTHER GAR WOOD PRODUCTS: HOISTS AND BODIES • TANKS • WINCHES AND CRANES • HEATING EQUIPMENT • MOTOR BOATS

GAR WOOD ROAD MACHINERY
WITH ALLIS-CHALMERS DIESEL POWER

Sold Through
ALLIS-CHALMERS
Tractor Dealers

ROAD MACHINERY DIVISION
GAR WOOD INDUSTRIES, INC.
DETROIT 11, MICHIGAN

THIS TOOL MAKES
Horsepower OUT
OF Manpower



Multiplies 50 pound Pressure at the grip of the handles to approximately 4,000 pounds at cutting jaws to

CUT

BOLTS • RODS
WIRE • CHAIN
CABLE • FLAT STOCK

. . . on the job. Quick, durable, efficient. Used all over the world, 65 years of specialized experience in the making. Sold wherever mechanics' tools are sold. Write for illustrated catalog.

PORTER CUTTERS *For Metals*

H. K. PORTER, INC., BOSTON 49, MASS.

pad having a flange running fore and aft in the manner of a car wheel flange, which enables the tractor to operate on railroad track. It also has the ability to maneuver on and off the track. It moves along the track spreading ballast uniformly and maintaining the grade accurately.

The tractor may be used quite as readily for off-track work. The blade attachments are easily removable.—*Electric Steel Foundry, Portland 10, Ore.*

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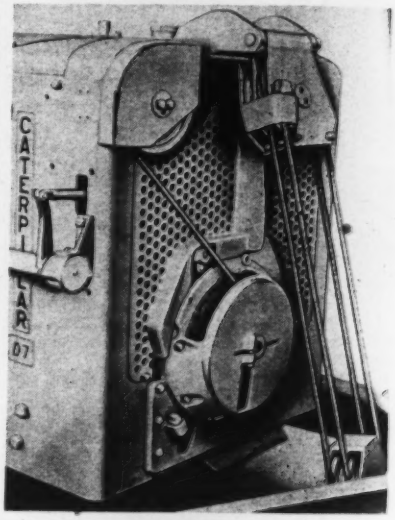

Cable Control Unit

Simple, easy operation of the new bulldozer for Caterpillar D8, D7 and D6 tractors is possible with a new single-drum, front-mounted cable control. Line pulls are said to be ample to meet the most severe service requirements imposed by bulldozer operation.—*Caterpillar Tractor Co., Peoria, Ill.*

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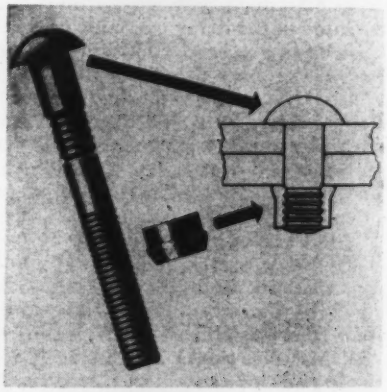
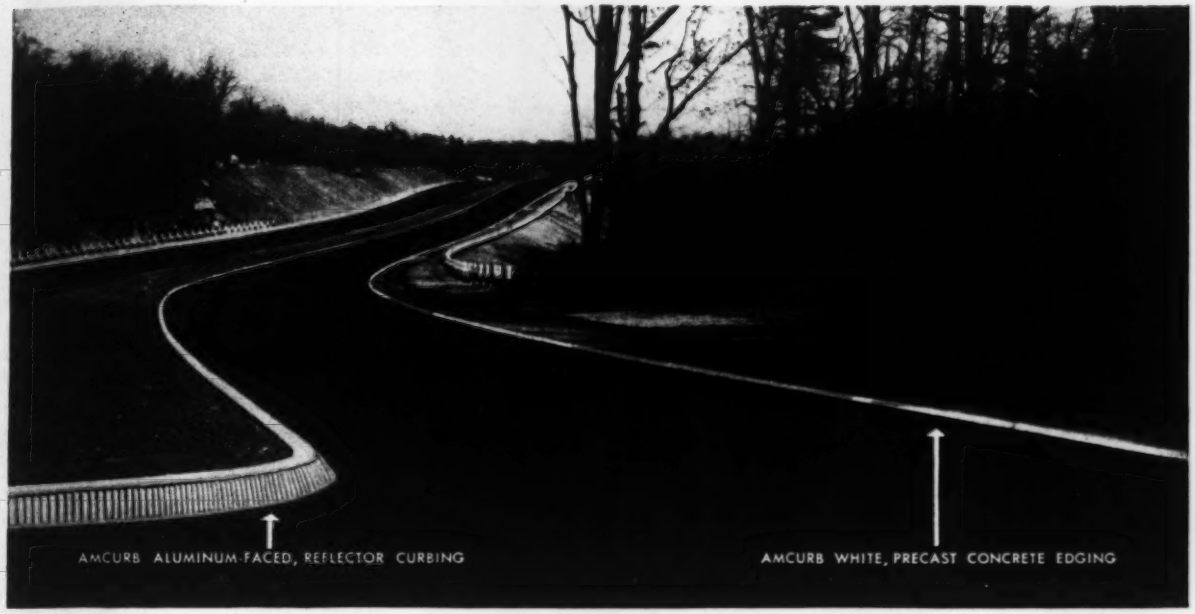
Lockbolt

Known as the Huck Lockbolt, a new and different type of fastener has been



announced. The Lockbolt is said to draw the work tightly together in the equivalent of a bolting-up operation, filling the

FOR SAFETY . . . FOR DURABILITY . . . FOR ECONOMY



Specify AMCURB Aluminum-Faced, Precast Concrete Curbing!

AMCURB Aluminum-faced, precast concrete curbing is a big step ahead in modern highway construction. It comes to the job in 10-foot prefabricated sections, ready for installation on concrete piers with patented, adjustable anchor. Only the piers are built on the job! Standardized **AMCURB** design provides metal-faced curbing that is economical any way you look at it!

AMCURB Curbing offers these important features which appeal to engineers and contractors:

SAFETY —

AMCURB'S aluminum facing is scientifically designed to reflect car headlights, clearly marking edges of highway or center islands.

DURABILITY —

AMCURB'S tough aluminum facing is non-corroding, non-rusting, wear resistant.

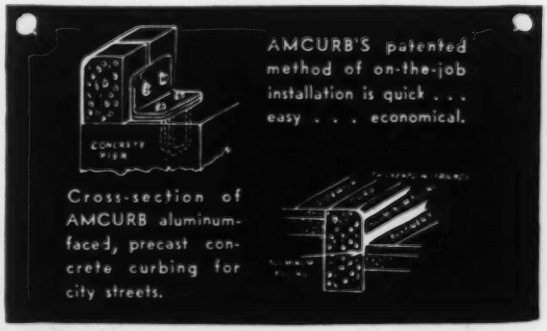
ECONOMY —

AMCURB aluminum-faced, precast concrete curbing is actually cheaper to install than the usual types of curbing because of the patented method of installation.

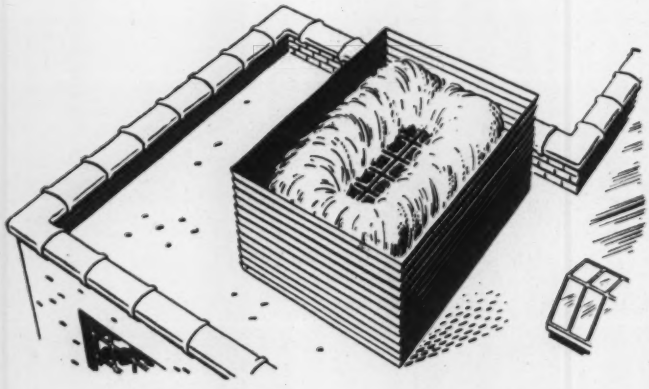
Specify AMCURB aluminum-faced, precast concrete highway curbing for new road building projects . . . wherever safety curbing is needed. Write today for specifications and name of AMCURB licensee near you.

Construction Material Manufacturers and Contractors

Some choice territories still available. Write for information.


AMCURB'S patented method of on-the-job installation is quick . . . easy . . . economical.
Cross-section of AMCURB aluminum-faced, precast concrete curbing for city streets.

AMERICAN STANDARD CURB COMPANY
11 Beacon Street
Boston 8, Mass.



LIKE BEING IN *Hot Water*
ALL THE TIME

There's trouble aplenty for ordinary wood when it goes into the construction of a cooling tower—exposed continually to a water spray, and the elements. Pressure treatment with Wolman Salts* preservative prevents the decay that weakens and destroys ordinary lumber in cooling tower frames and louvers. Records show Wolmanizing extends the life of wood in this service from two to four times.

Maybe the conditions are not quite so severe with the structure you're building, but—Wolmanized Lumber is famous for resistance to decay and termite attack.

Whatever your needs—
AMERICAN LUMBER GIVES YOU ALL 3

1 Wolmanized Lumber—protects against decay and termite attack
2 Minalith—fire-retardant
3 Creosoted Lumber

AMERICAN LUMBER & TREATING COMPANY

CREOSOTING
FLAMEPROOFING
WOLMANIZING

*Registered trademarks

1649 McCORMICK BUILDING, CHICAGO 4, ILLINOIS

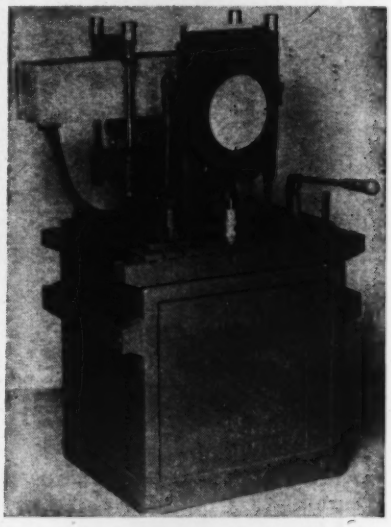
hole completely when required, and then is rigidly and permanently locked in place like a rivet. The fastener consists of two precision parts, a pin and a locking collar.

The Lockbolt is said to be more quickly installed than a bolt, and to form a permanent fastening that cannot loosen under vibration or fatigue loading.—*Huck Mfg. Co., Detroit, Mich.*

• • •

Hydraulic Beam Breaker

This device produces a chart record of concrete test so that a precise and permanent chart record of either a third-point or a center-point flexural strength



test of concrete can be produced quickly in the field, as well as in the laboratory.

Two easily operated pumps and a chart track make possible a controlled rate of loading which will be uniform for all tests. The weatherproof cover serves also as a convenient height operating base.—*Rainhart Co., 602 West 34th St., Austin 21, Tex.*

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Hydraulic Truck Crane

A new model H-2-C all hydraulic truck crane with a 2-ton lifting capacity has been developed for industrial and contractor's use. There are no gears, drums or clutches in the machine, and the crane is operated by the truck engine. The boom is telescopic under load both ways from 14 ft. to 22 ft. The crane is built for full revolving, has a line speed of 75 in. per minute, and a boom hoist of 60 in. per minute.

Attachments for the machine will be a new all hydraulic shovel front, which carries no rack or pinion gears, but is operated with a telescopic boom and a hydraulic combination digging and rehandling bucket.—*Milwaukee Truck Crane Co., 30 No. La Salle St., Chicago 2, Ill.*

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A SUPER-PORTABLE BATCH TYPE ASPHALT PLANT

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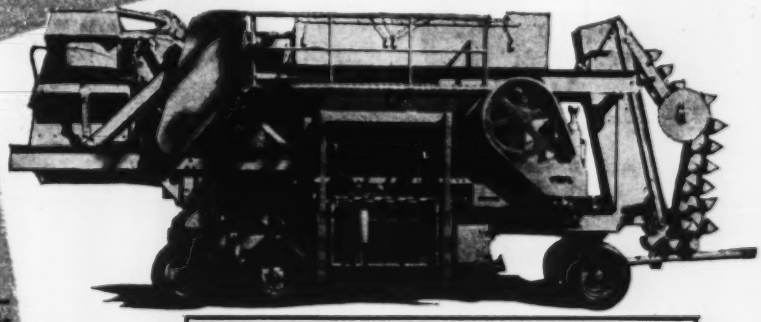

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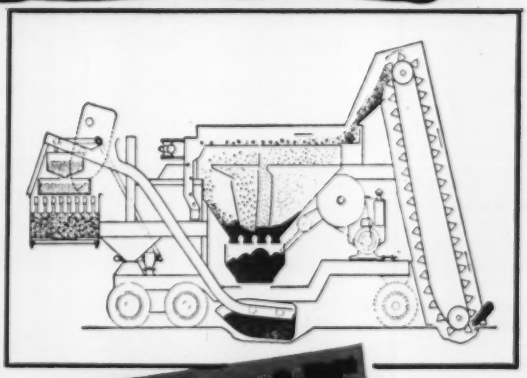

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Elections and Activities

The Pennsylvania Society of Professional Engineers reports 348 new members the last year and has elected these officers: LeRoy F. Christman, Reading, president; J. Rossa McCormick, Scranton, John R. Shoffner, Kittanning, Mark E. Smith, Erie and Victor J. Snyder, Harrisburg, vice-presidents; and Ray M. Fuller, Philadelphia, national director.

The new officers of the Minnesota Federation of Engineering Societies are as follows: President, S. L. Stolte, St. Paul; 1st vice-president, Paul R. Speer, St. Paul; 2nd vice-president, H. E. Farnam, Duluth; 3rd vice-president, H. G. Nicholson, St. Paul and treasurer, John L. Wilson, St. Paul.

Officers of the Minnesota Association of Professional Engineers are: President, H. E. McWethy, Minneapolis; vice-president, Mark G. Brataas, Rochester; secretary, T. S. Thompson, Minneapolis and treasurer, W. S. Cockroft, St. Paul.

New officers of the Minnesota Surveyors' and Engineers' Society are as follows: president, H. E. Palmer, Hastings; vice president, Wm. G. Klett, St. Paul, and secretary-treasurer, J. M. Evans, St. Paul.

J. G. Bennett has been re-elected president of the Building and Construction Industries Exchange of British Columbia. A. J. Armstrong, was elected first vice-president, and F. Welsh second vice-president. Directors elected for a two-year term were: E. R. Gilley, Walter Leek, and A. S. Gentles. J. Tucker, F. J. Hale, and R. C. Pybus will serve as directors (for another year).

A. B. Carson, assistant city sewer superintendent of Ft. Worth, is the new president of the North Central Texas Water & Sewage Association. Other officers: D. W. Robinson, chief engineer for Community Public Service, vice-president; W. M. Robinson of the Ft. Worth water dept., secretary and treasurer.

A Montana section of the American Society of Civil Engineers has been organized with C. S. Heidel, hydraulic engineer for the U. S. Geological Survey, as president. David M. MacAlpine of Bozeman, professor of general engineering at Montana State College, was elected first vice-president; George G. Sahinen of Helena, engineer for the state water conservation board, second vice-president; and R. H. Willcomb of Helena, associate maintenance engineer for the state highway department, secretary-treasurer. Meetings will be alternated among six cities.

H. Earl Parker, Marysville general contractor, has been named president of the northern California chapter of the Associated General Contractors. Guy F Atkinson, San Francisco, was elected vice-president.

Members of the Northeastern Section of the American Society of Engineers met in Boston recently and elected Harvey B. Kinnison as president; Emil Gramstorff, Northeastern University, vice-president; Howard J. Williams, secretary-treasurer.

T. J. Hewitt, chief of the engineering division of the Army Engineer office at Wilmington, was recently elected president of the North Carolina Society of Engineers, at Raleigh.

Associated General Contractors of Missouri recently elected Otto W. Knutson, of Kansas City president. Other officers: E. W. Menefee, Sedalia, vice president; James M. Joyce, Keokuk, Iowa, treasurer, and E. C. L. Wagner, Jefferson City, Mo.

The Associated Engineers of Spokane, Wash., have awarded life memberships to Homer C. Bender, A. A. Booth, Louis Delivuk, Harold J. Doolittle, Dwight F. Henderson, Frederic Keffer, Charles J. Melrose, James S. McNair, Arthur E. Petersen, L. J. Pospisil, Lou S. Robinson, F. L. Rohrback, Henry C. Swann and J. Turner. New officers are J. G. McGivern, president; H. C. Bender, first vice-president; Noel Thompson, second vice-president; Bliss Moore, third vice-president; W. L. Thrailkill, fourth vice-president; H. C. Swann, secy.-treas.

Henry Thygessen, Albuquerque, was elected president of the New Mexico Highway Contractors Association at the recent annual meeting. Other officers elected are: J. H. Ryan, Albuquerque, vice-president; N. J. Skousen, Albuquerque, treasurer; E. M. Silver, Albuquerque, and W. T. Bookout, Las Vegas, members of the board of directors.

Merton M. Memler, district engineer of design, Illinois Division of Highways, Dixon, has been elected president of the Rock River Chapter of the Illinois Society of Professional Engineers. Other officers are: vice president, Archie W.

Brown, Dixon; secretary-treasurer, A. H. Ferger, Dixon; chapter representative on the I. S. P. E. board of directors, H. F. Walder, Dixon. The new officers, Miles Lamb, and C. F. Andrews, past presidents of the society, constitute the executive committee.

V. E. Scott, associated with the Reconstruction Finance Corporation, has been elected president of the Arkansas Engineers Club, succeeding Frank Gruver. Other officers elected: E. E. Mashburn, vice president; Mike Thomas, secretary-treasurer, and R. A. Kern, steward. The board of directors is composed of Mr. Gruver, chairman; D. B. Hill Sr., Jack East, Ben Hogan, and Snow Wilson Jr.

New officers of the Ohio Society of Professional Engineers are: A. C. Neff, Cleveland, president; J. D. Coleman, Dayton, and Alfred Le Feber, Cincinnati, vice presidents, D. W. Converse, Akron, secretary, and J. R. Shank, Columbus, treasurer.

The Master Builders Association of Iowa has re-elected three of its officers: J. Peter Olesen of Waterloo, president; Orlin J. Conlin of Dubuque, secretary and W. F. Kucharo of Des Moines, treasurer. A. R. Coffeen of Decorah, who has been serving as a director, was named vice-president.

L. C. Crawford, Iowa City, district engineer for the Iowa Geological Survey, was advanced to the presidency of the Iowa Engineering Society at its recent fifty-seventh annual convention. Frank Kerekes, professor of civil engineering, Iowa State college, was chosen to become president at the 1947 convention. Other officers chosen were: William P. Nemmers, consulting engineer, Nemmers, Clark and Spooner, Des Moines, vice president; E. F. Behrens, Brown Engineering Co., Des Moines, treasurer and A. F. Faul, Des Moines resident engineer, state highway commission, secretary.

Representatives of municipalities, industry, health and conservation agencies, federal departments and the Mohawk Valley Towns Association have formed a Mohawk Valley Sanitation Council, in an endeavor to clean up the pollution in that stream in central New York State. This organization was created at a Mohawk Valley Pollution Abatement Conference conducted at Union College Schenectady, N. Y., recently under the auspices of the Schenectady Engineering Council, a group of local technical and engineering societies, in cooperation with the New York State Department of Health, New York State Conservation Department, Mohawk Valley Towns Associa-

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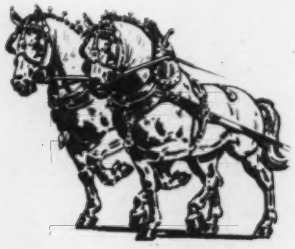

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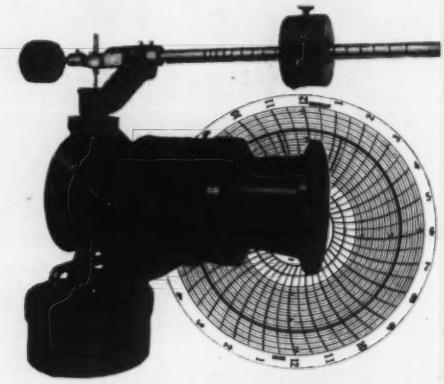

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tion, New York State Conference of Mayors, Schenectady County Conservation Council, Schenectady Chamber of Commerce, Schenectady Junior Chamber of Commerce and the Capital District Section of the N. Y. State Sewage Works Association.

Morris M. Cohn, sanitary engineer of Schenectady and editor of "Sewage Works Engineering," was elected chairman of the Sanitation Council. A steering committee consists of the following members:

Representating municipalities: Charles E. Merritt, City Engineer, Utica; Fred H. Durfee, City Engineer, Gloversville;

Representing Mohawk Valley Towns Association: Mayor Clifton E. Wagoner, Little Falls; Mayor James T. Bergen, Fonda;

Representing Health: Earl Devendorf, assistant director, division of sanitation, N. Y. State Department of Health, Dr. F. E. Coughlin, district state health officer, N. Y. State Department of Health;

Representing Industry: J. W. Vosburg, Vice President, Beechnut Packing Company, Canajoharie; H. V. Crawford, Industrial Engr., General Electric Company, Schenectady;

Representing Conservation: J. S. Apperson, Schenectady County Conservation Council; E. Richard, Montgomery County Conservation League;

Representing Federal Agencies: Arthur W. Harrington, District Engineer, U. S. Geological Survey, Albany; Wm. H. Baldwin, U. S. Engineers Office, Albany.

The Wisconsin Society of Professional Engineers has elected the following officers: President, Edwin A. Seeger, Milwaukee; first vice-president, Walter A. Pierce, Racine; second vice-president, Charles S. Whitney, Milwaukee; secretary, O. J. Muegge, Madison; treasurer, L. M. Schindler, Appleton; National Representatives, Lawrence E. Peterson, Milwaukee, and Prof. Ben G. Elliott, Madison; Directors, Archie E. Becker, Richard E. Cannard, E. J. Kallevang, Grover Keeth, and George W. Martin.

M. P. Hunter of Seattle has been elected president of the Pacific Northwest branch, Associated General Contractors, with Paul Fiorito, also of Seattle, as treasurer. The branch is composed of two chapters each in Seattle and Portland, Ore., and one each in Tacoma, Wash., Spokane, Wash., and Boise, Idaho.

W. L. Booth, manager of the Seattle, Wash., branch of Clyde Equipment Co., has been elected president of the Associated Equipment Distributors of Seattle. L. J. Aichlmayr, Howard-Cooper Corp., was elected vice-president, and Howard Stephens, Northern Commercial Co., secretary-treasurer.

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"You bet I will. It's by far the best for factory floors and platforms. Stands up under all kinds of traffic ... and it's warm and resilient, a real comfort to those who work on it. Furthermore, it's quick and easy to install ... self-healing from scars and rutting."

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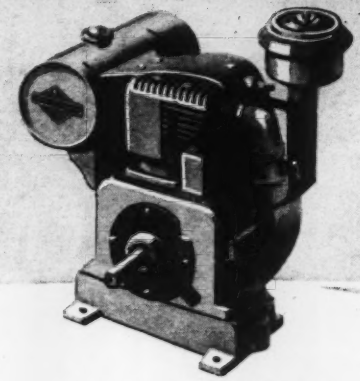

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Men and Jobs

Carl G. Paulsen has been appointed chief hydraulic engineer, effective March 1, to succeed Glenn L. Parker. Mr. Paulsen has served continuously in the U. S. Geological Survey since September, 1913, except for a few months in the Army during the First World War.

He was district engineer for a year and a half in the South Atlantic States and for nearly twelve years in Boise, Idaho; as chief of the surface water division for eight years; and as assistant chief hydraulic engineer for six years. He has a thorough knowledge of the activities of the Water Resources Branch and the relation of those activities to the functions of other Survey branches and of other government bureaus and departments.

F. W. Sarvis, Albia, Iowa, engineer of Monroe County for the last year, has resigned to become Keokuk County engineer. He fills the post vacated by **Floyd Brown** who recently transferred to Leon, Ia., to be Decatur County engineer. A graduate of Iowa State College, Sarvis has had 25 years experience as an Iowa highway engineer.

R. J. Walter has been appointed construction engineer on the Balmorhea project in Reeves County, Tex. He will superintend construction of irrigation facilities to provide an additional water supply to the Reeves County Water Improvement District No. 1. He is an engineer of 20 years experience, the last ten with the Bureau of Reclamation. After his graduation from Colorado University and New Mexico School of Mines, he worked with the Middle Rio Grande Conservancy District and the Rio Grande Canalization Project before joining the bureau in 1936. He served as concrete and earth work engineer on the Caballo Dam project, was concrete engineer on the Elephant Butte hydro-electric power plant, and for the last year and a half has served as field engineer on the Tucumcari, N. M., irrigation project.

Millard E. Smith of the Office of Inter-American Affairs has been appointed associate chief of party and sanitary engineer for Nicaraugua. A graduate of the University of Cincinnati, College

The men behind the DRILLS Prefer

TIMKEN BITS

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This is reflected in lowered costs for the mine operators due to saving in steel; virtual elimination of tramming; conservation of man hours.

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Now is the time to check into your drilling costs and to begin to reduce them by the adoption of Timken Bits — if you have not already done so. The Timken Roller Bearing Company, Canton 6, Ohio.

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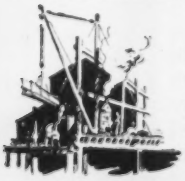

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of Engineering and Commerce, with the degree of civil engineer, Mr. Smith was released by the War Department December, 1945, with the grade of captain, Sanitary Corps, AUS. While in the Sanitary Corps he served with the theater malaria control officer for the United States Army Force, South Atlantic, with headquarters in Recife, Brazil.

Leo Shadic, who has been plant engineer at the MacIntyre development of the National Lead Co. since beginning of production operations in 1942, has returned to his former private practice of engineering and land surveying at Philmont, N. Y.

John Rippstein has joined the highway department of the N. Y. State Department of Public Works. With the title of assistant engineer he has been assigned to the Buffalo district, which includes the counties of Erie, Niagara, Cattaraugus and Chautauqua.

The Minneapolis, Minn., civil service has certified **Maj. Harold S. Adams** for the position of chief sanitarian in the city health department. Major Adams has been with the U. S. Public Health Service in Washington, D. C.

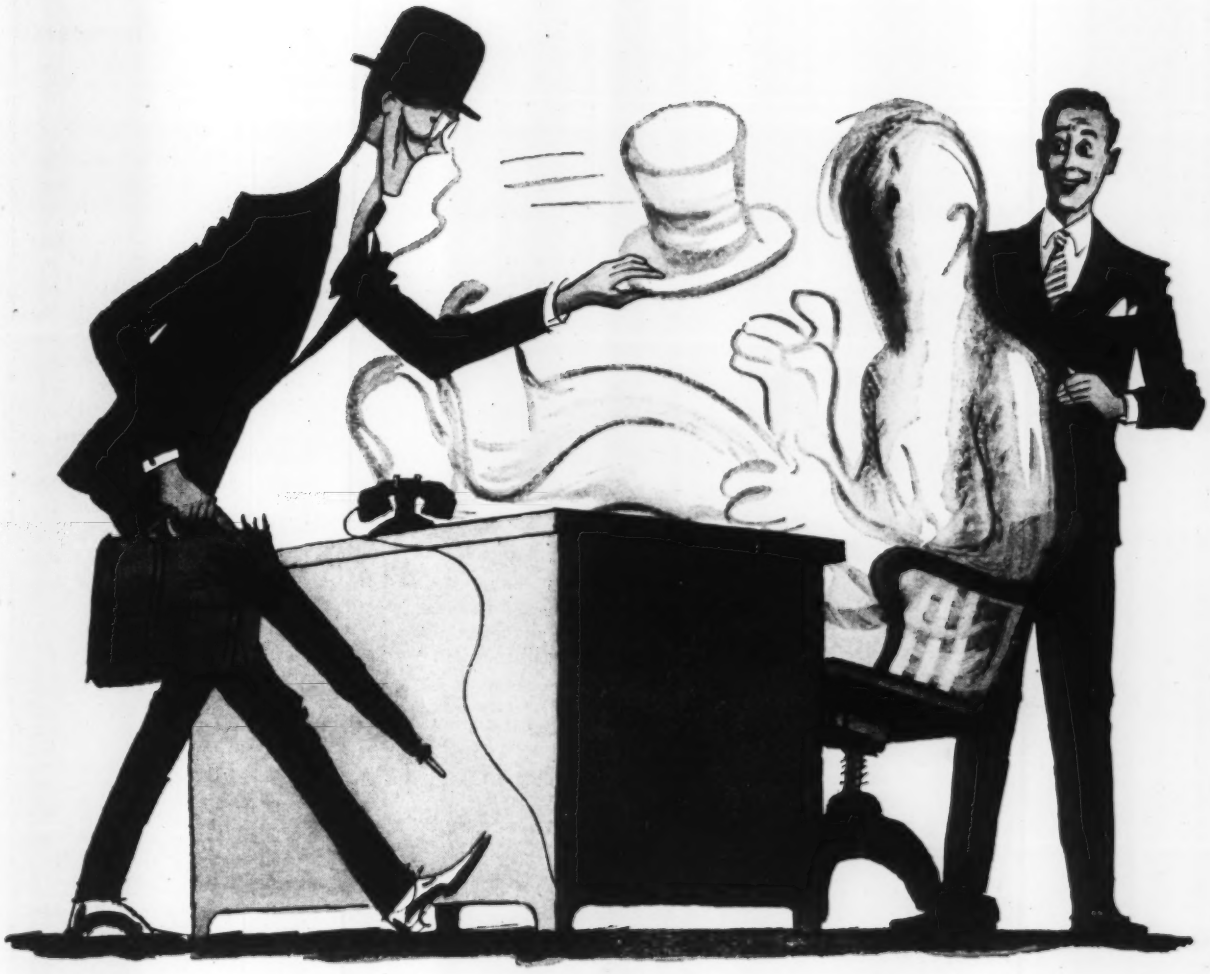
The Minneapolis-St. Paul Sanitary District has appointed **Warren Sleeger** of St. Paul, assistant engineer for the Twin Cities Sewage Disposal Plant. Mr. Sleeger fills a vacancy left last July when **William McIlvane, Jr.,** resigned to take a position with the American Public Works Association.

Recent county engineer appointments in Iowa include **Milo A. Rubek** in Audubon county, **Fred Pfaff** in Jefferson county and **Orville T. Upp** in Wapello County. Mr. Upp leaves a similar position in Davis County where he has been the last two years. Mr. Pfaff, who was recently discharged from the service, was formerly assistant engineer in Keokuk County.

Floyd Brown of Sigourney has resigned as Keokuk County engineer and is returning to Decatur County, Iowa, where he served as engineer for six years prior to 1934. **Roscoe Brady** resigned recently as Decatur County engineer to go into business in Leon.

Grover C. McGimsey, Lenoir, N. C., engineer, has been appointed superintendent of the municipal public works department there.

James A. Riviere of Lake City, Fla., has been employed as county engineer of Orange County. He is an honor graduate of Georgia Tech.



"Don't let him haunt you," says Mr. Friendly

There I was in my office one morning, when the door opens and this washed-out thing walks in.

"Ha-ha-ha-" the thing croaks. "You haven't got a chance. I'm all of your contractor's troubles rolled into a bundle of misery. What are you going to do about the rising cost of labor and materials? How about accidents that may hold up important jobs? Suppose you don't meet completion dates? I've come to stay, brother, and I'm going to be here a long time."

Just as he hangs his hat up, Mr. Friendly walks in.

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The thing pales. Suddenly he stops laughing.

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Then Mr. Friendly turns to the thing and hands him his hat. And by Gosh, the thing just gets up and walks out.

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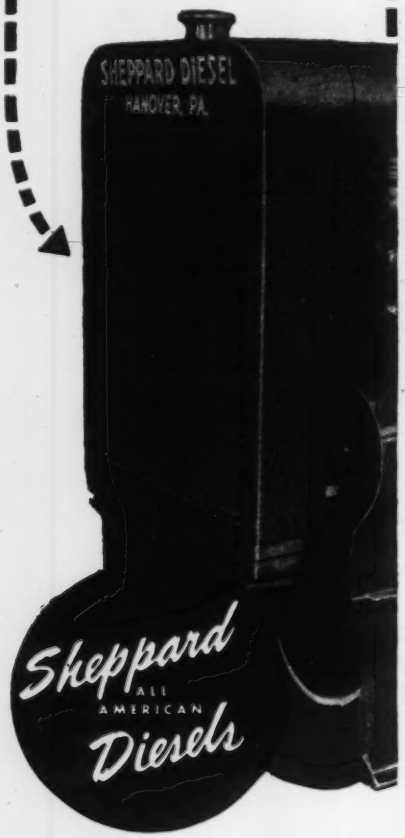

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Lt. Col. William S. Little, Corps of Engineers, has become associated with W. N. Brown, Inc., Washington, D. C., as chief engineer. This firm specializes in topographic, geodetic, and photogrammetric surveys. Colonel Little was assigned to the Engineer Board at Ft. Belvoir, Va., where he served as chief of the surveying section.

Maj. Gen. John C. Swan, who was with the U. S. Engineers office at Wilmington, N. C., for many years and for the last year in rivers and harbors work in the Philippines, has returned to his home at Southport, N. C., to await further assignment.

Ernest Edward Newsom, of Durham, N. C., who received his civil engineering degree from Duke University in 1944, now is a lieutenant junior grade in the USNR, CEC, is assigned to the 82nd Naval Construction Battalion.

Neil R. McKay of Olympia, Wash., has been named state aid engineer in the Washington State Highway Department, his former post of work control engineer going to **E. C. Simpson,** previously district engineer at Vancouver.

Howard Taylor, formerly assistant Pend Oreille County engineer at Newport, Wash., has been appointed Okanogan County engineer at Okanogan, Wash.

Edward E. Hall, former bridge designer for the State Road Department at Tallahassee, Fla., has been named city building inspector of Tallahassee. He succeeds **Robert Brown,** who resigned to join the Culpepper Construction Co. of Tallahassee.

Stephen E. Kovach, Jr., lieut. colonel, Corps of Engineers, until recently post engineer at Air Transport Command's Morrison Field, will reenter the general construction business in the Palm Beach, Fla., area and in Pittsburgh, Pa. One of the largest private builders of rental housing in the Pittsburgh Area before he entered the service in October, 1942, he has revealed plans for immediate construction of 72 apartment units for veterans housing in West Palm Beach.

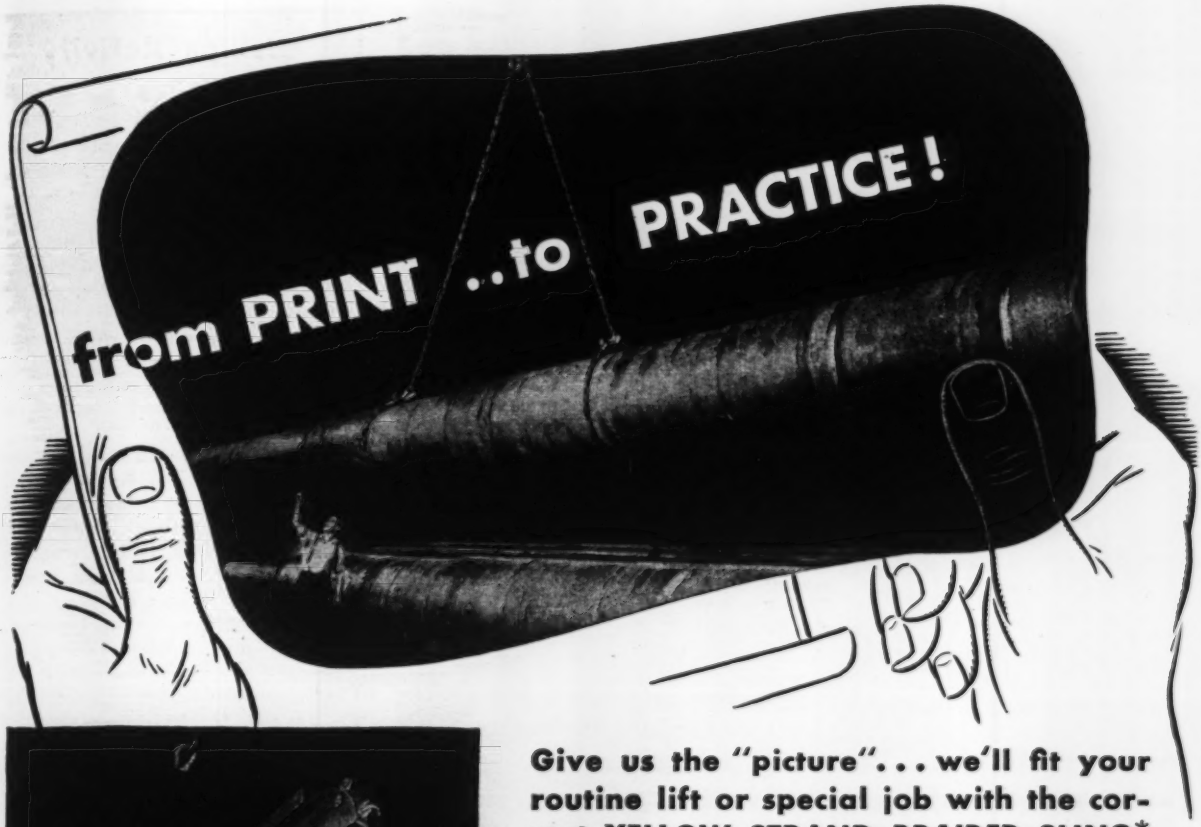
About District Engineers

Col. Wendell P. Trower is new district engineer at Chicago, succeeding **Col. H. J. Woodbury.**

Thomas J. Hewitt and **Paul M. Snell,** division chiefs of the U. S. Engineering office at Wilmington, N. C., have been given the War Department's Exceptional Service Award for outstanding service during World War II. Oldest civilian division chiefs in the South Atlantic Division, Hewitt and Snell during the war were charged with several top-priority projects and jointly directed $120,000,000 worth of new building of military establishments in North Carolina, including Camp Butner, Seymour-Johnson Field, Bluethenthal Army Air Base, Greensboro AAF Replacement Center, and the Raleigh-Durham Airport. Hewitt has been with the Wilmington Engineers' office since 1913, and Snell since 1919.

Stuart M. Heagy, Lemoyne, Pa., chief of the redistribution and salvage branch, North Atlantic Division, Corps of Engineers, New York City, since March, 1944, has been promoted to lieutenant colonel, it has been announced by **Col. C. L. Hall,** division engineer. As chief of the R & S Branch, Lieut. Col. Heagy has been responsible for the redistribution and disposal of excess and surplus material including both military and non-military property received from Overseas theaters, offshore bases, construction projects, posts, camps and stations. Prior to entering the service six years ago as a second lieutenant, he was employed by FWA and WPA in charge of federally-owned and leased buildings located in Pennsylvania and used by federal and state relief agencies.

Col. R. A. Lincoln, graduate of West Point, 1925, and since continuously in the service of the Army Engineers, has arrived in Memphis, Tenn., to become military assistant in charge of operations for **Col. Bartley M. Harlow,** U. S. district engineer at West Memphis. Colonel Lincoln was in the service in the East where he was decorated with Legion of Merit award, and was transferred to the Pacific for eight months, serving in New Guinea and Manila. The position at West Memphis is a newly created one. As part of the change, **Col. Garner W. Miller,** executive officer of the Memphis Engineer district reverts to civilian status as principal engineer, but will continue in his present position. He was a civilian engineer before the war and served as district engineer at Memphis.



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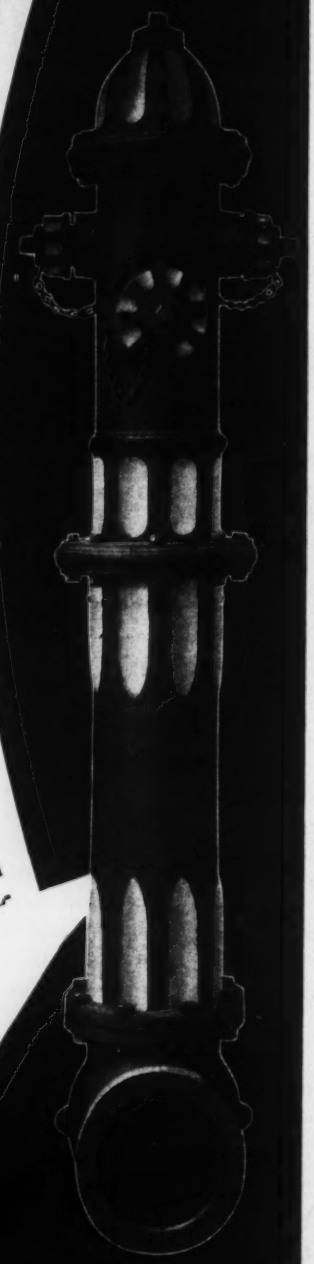


MUELLER CO., CHATTANOOGA, TENN.
DECATUR, ILL. LOS ANGELES, CALIF.

Civilian Activity

Gordon H. Butler, colonel C.E., after four and a half years in the Corps of Engineers in Europe and the Pacific, has returned to the presidency of the Polaris Concrete Products Co., Duluth, Minn.

Thomas Llewellyn Cordle, of Charlotte, N. C., recently discharged from the Navy, has been appointed city manager of Lancaster, S. C. He has been consulting engineer on the design of a new naval hospital at Beaufort, S. C.

Henry M. Bremer, major, Air Corps, of Wilmington, N. C., has become program and planning engineer for the North Carolina district, Federal Works Agency, Public Roads Administration, at Raleigh, N. C. Before entering the Air Forces, he held a similar position with the Public Roads Administration, at Columbia, S. C.

John F. Berry, recently discharged from the Navy, has returned to his position as Tama County engineer at Toledo, Iowa.

Charles G. Anderson, with the Bureau of Reclamation since 1924, has been appointed regional engineer. As lieut. commander, Anderson served as executive officer for a Navy construction battalion in the Pacific.

H. L. Hertzog, major, former engineer of design with the Atlantic Coast Line Railroad at Wilmington, N. C., has rejoined the railroad as assistant bridge engineer.

Wolford T. Gradison, major, Army Engineer Corps, has returned to Indianapolis, Ind., as a partner in the Tri-State Construction Co.

W. A. Danielson, brigadier general, former commanding general of the Memphis Army Service Forces Depot, has been named consultant to the War Assets Corporation at Memphis. He will travel throughout the South for WAC, as a liaison man between the field operations and Administrator Edmund B. Gregory. He is now on terminal leave from the Army.

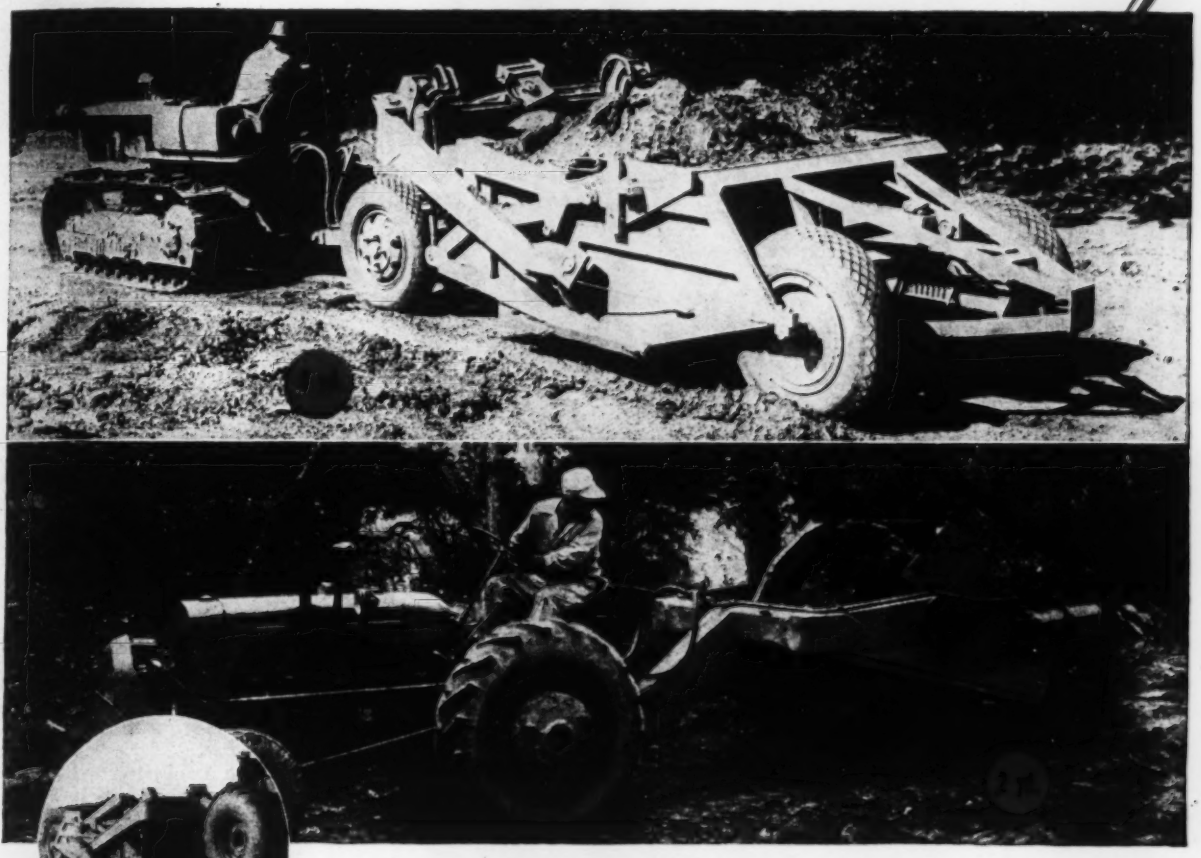
Bert Moskowitz, captain, Corps of Engineers, has been appointed civil engineer with the Illinois Post-War Planning Commission.

Paul A. Troemper, captain, Army Sanitary Corps, has returned to the division of sanitary engineering, Illinois Department of Public Health, Springfield, as sanitary engineer.

Paul A. E. Flux, captain, CEC, USNR, has returned from five years naval service to the Connecticut State Highway Department, design division, at Hartford, Conn. His last assignment was Officer-in-Command of the Seabee's Advance Base Depot at Davisville, R. I.

How to make your small tractors

earn more money



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● Here are two of the greatest little scrapers you've ever seen for ditching and shoulder work . . . digging stock ponds . . . filling in around culverts and bridge abutments and for all other kinds of light excavation, stripping, grading and hauling. Choice of 2- or 4-yard capacity for use with small crawler-type or high-speed, rubber-tired industrial tractors. Thrifty to buy. Easy to operate and maintain. Job-proved by extensive war-time use. Write today for complete facts. LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa; Oakland, Calif.

LOOK WHAT YOU CAN DO!

● Here's a reasonable estimate of the number of yards moved per hour by LaPlant-Choate C-22 and C-42 scrapers behind high speed rubber-tired tractors of 22-28 DHP and 40-50 DHP respectively. Yardage is based on self-loading in good scraper material, with properly maintained haul roads.

Model	LENGTH OF HAUL IN FEET								Load, Turn and Dump Time	Per Yards Per Trip
	200	300	400	500	600	800	1000	2000		
C-22	38	32	29	26	24	22	21	17	1.5 Min	1.75
C-42	69	59	55	52	50	46	44	32	1.75 Min	3.75

*Reg. U.S. Pat. Off.

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DRAVO

Robert S. Beightler, major general, commander of the 37th Infantry Division which saw 42 months service in the South Pacific, is expected to return soon as partner in Stellhorn and Beightler, contracting engineers, Columbus, Ohio. General Beightler was employed by the Ohio Department of Highways, joining it in 1920 and advancing to chief engineer in 1928. In 1939, following eight years of private engineering practice, he was appointed director of highways for Ohio, which position he held until assuming command of the 37th Infantry Division the following year.

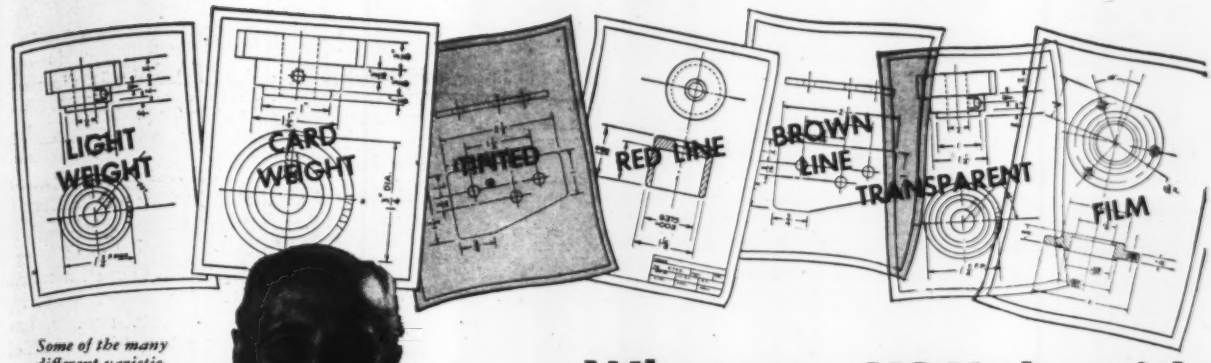
Earl E. Jackson, lieutenant commander, CEC, USNR, has joined the Case Contruction Co. as engineer at the San Diego, Calif., office. Two of Mr. Jackson's four years in the service were on advanced base construction out of Panama, and for two years he was project manager on construction of naval air bases in the Eleventh Naval District, San Diego. A 1932 University of California graduate, Jackson was formerly with the California Division of Highways in Los Angeles.

Frank R. Blaisdell of the office of Inter-American Affairs, has gone to La Paz, Bolivia, to join a field party as sanitary engineer. He received a B.S. degree in civil engineering from the University of Maine and a S.M. degree in sanitary engineering from Harvard University.

Mr. Blaisdell entered the United States Army as a first lieutenant in February, 1941. He was relieved from active duty in November, 1945, holding the rank of lieutenant colonel. He was at one time commanding officer of the Southern Division of the Alaska Highway.

Lieut. Col. Holmes H. Bevington, of Gooding, Idaho, a civil engineer with the Idaho State Highway Department before entering the Army in April, 1941, has been appointed assistant executive officer of Fort Bragg, N. C. He has been commander of the 15th Training Battalion of the Field Artillery Replacement Training Center at Fort Bragg.

Appointment of **Ronald C. Reeve** to the U. S. Regional Salinity laboratory



Some of the many different varieties of BW Prints.

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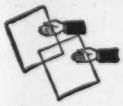
What print-making advantages does the Bruning BW system give me?

BW Prints—black line positive prints made *directly* from your tracings—cover a wide variety of needs. In addition to the regular (medium-weight), BW Prints may also be produced on a lightweight white paper for greater convenience in filing. BW Prints, too, can be made on card-weight paper where durability is required. For departmental differentiation, BW Prints may be made with black, brown or red lines on green tinted paper, or brown and red lines on white paper.

How can I use BW transparents and BW film?



BW Transparents safeguard valuable original tracings by providing exact duplicates on thin, transparent paper. BW Transparents are also useful in making changes without altering original drawings. BW Film—a matte finish transparent acetate film—is used to intensify the lines of pencil tracings in productions, thus increasing printing speed and assuring clean, sharp detail in subsequent BW Prints produced from the BW film.

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The Model 2 BW and Copyflex Printer—one of many Bruning machines—enables you to change at will from BW Prints to Copyflex photographic prints. Copyflex prints may be made from anything drawn, typed, written or illustrated on opaque material and one or both sides of the original may be reproduced. Increase the flexibility of your print production with this versatile Bruning equipment.

You Get These Six Major Advantages with the BRUNING BW SYSTEM

1. A versatile, simple method for making black line or colored line prints directly from tracings.
2. 17 years' experience in analyzing printmaking needs.
3. A complete line of materials, including white and green-tinted papers, thin, medium and card-weight papers, black, red or brown line prints, BW Transparents to supplement original tracings and BW Film for intensifying pencil lines in reproduction.
4. A complete line of printing and developing machines to fit every requirement.
5. A continuing service . . . because Bruning sells everything for the engineer and draftsman, not just BW equipment. Buying a BW machine is, therefore, not a "one time sale."
6. Continuing research and development in the customer's interest.

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fact 4 *You can pour better concrete with them.* The UNI-FORM Tie locks the Panels together to provide tight joints, accurate forming and spreading. Positive alignment assures straight walls of uniform thickness.

fact 5 *There are no extras for you to supply.* The UNI-FORM System of Foundation Forms is complete—everything is included. Panels are 2′ wide and come in 6′, 7′ and 8′ lengths.

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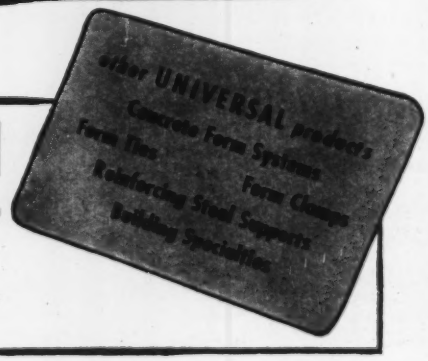

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staff, and his assignment to work with **J. E. Christiansen,** irrigation engineer, on a Coachella Valley study, is announced by **H. E. Hayward,** director. The study is a joint project of **J. H. Snyder,** engineer of the Coachella Valley County Water district, and **Martin Hubberty** and **A. F. Pillsbury,** irrigation experts of the University of California at Los Angeles.

John D. Hall, formerly superintendent of the department of water, Waverly, N. Y., for the last fourteen years, has become general superintendent and chief engineer of the water department.

James Pullan, Taylor County, Iowa, engineer has resigned to become city manager of Clarinda. He has been in the Taylor County engineer's office at Bedford since 1935.

I. E. Wooten, Raleigh, N. C., civil engineer, has been retained to make a survey at Norlina, N. C., to determine the cost of providing a complete new water and sewerage system.

Lieut. Col. Allan N. Johannesen, a veteran of 21 months in the China-Burma-India theater, has been appointed chief of the engineering division at the Jeffersonville, Ind., Quartermaster Depot, succeeding **Col. Lloyd M. Morris,** recently relieved from active duty.

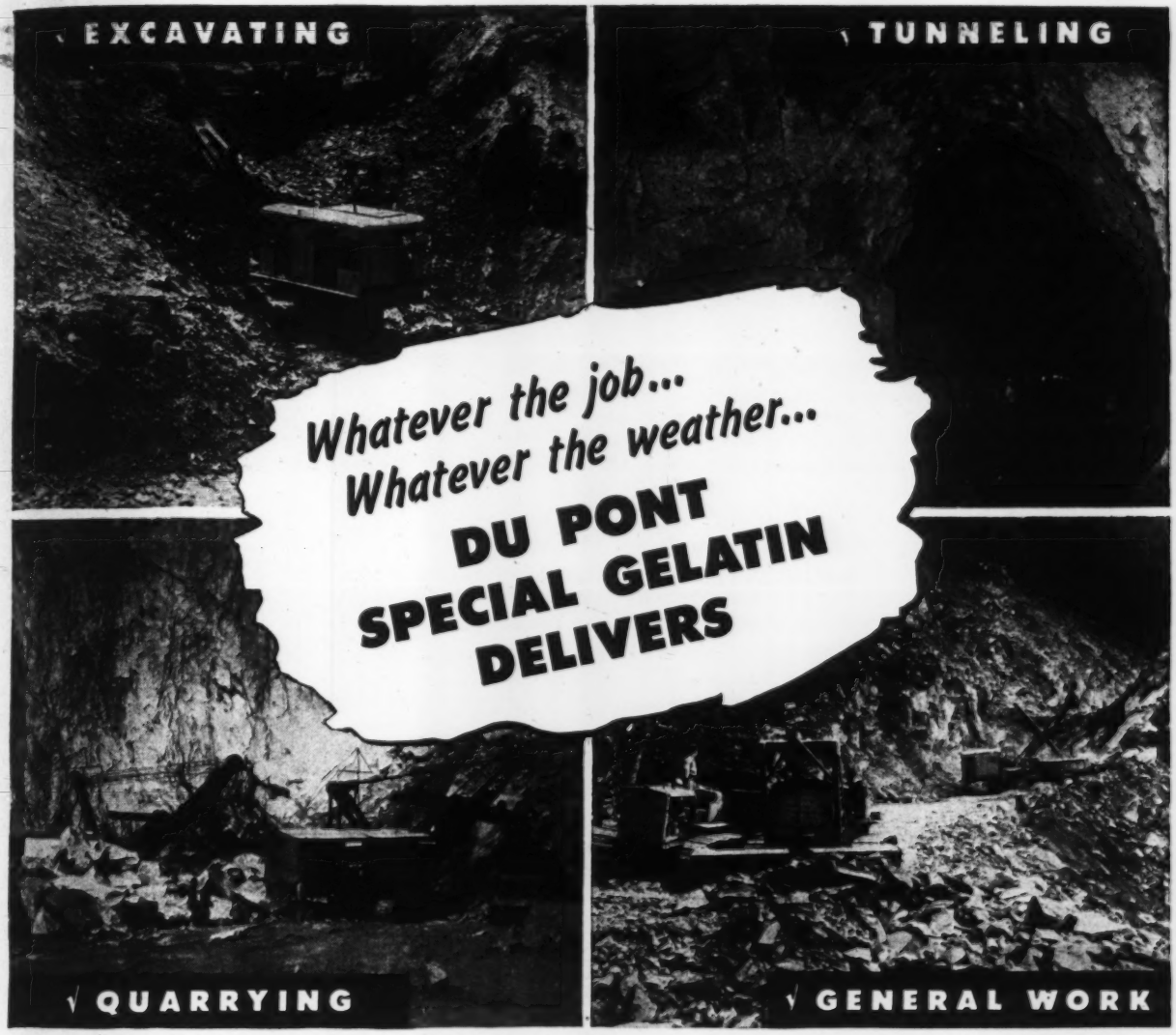
Lee M. Bush, former city engineer of Tulsa, Okla., has been chosen by the Research Institute of that city to check municipal expenditures under the bond issue program.

Herbert Eastwood of Jacksonville, N. C., who has been connected with a private engineering firm, has been named city engineer at Jacksonville.

Marshall Jones, who has been with the state highway department in Nebraska for a number of years, resigned recently to become general manager of the Western Contracting Corp., Sioux City, Iowa.

D. M. Vye, of Derby Junction, N. B., has been named development engineer of the New Brunswick Resources Development Board.

Robert H. Whittaker has been appointed construction engineer in the state highway department, New Hampshire, succeeding J. O. Morton, resigned. A graduate of Rensselaer Polytechnic Institute, 1934, Mr. Whittaker entered the department and served until 1942, when he joined the U. S. Navy, advancing to lieutenant-commander. In 1945 he returned to the highway department.



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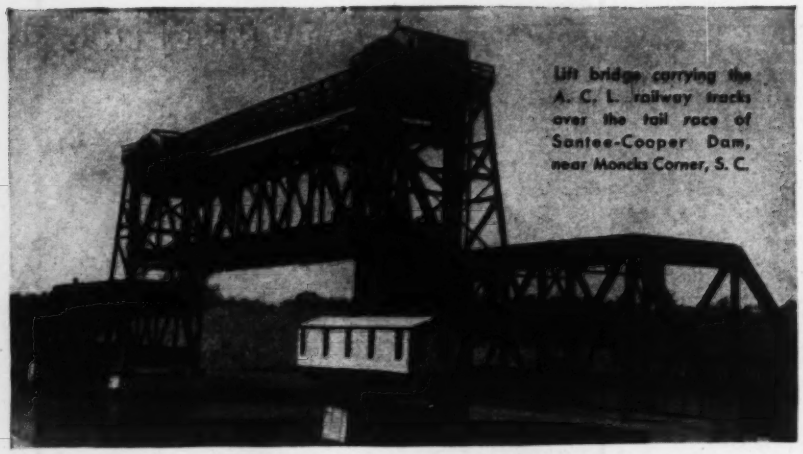

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Manufacturers' Activities

H. O. PENN MACHINERY CO., INC., has announced the acquisition of controlling stock interest in the company equally by Ralph L. Johnson and Stuart A. Wade, in accordance with the wishes of Hamilton O. Penn, late president of the company.

Ralph L. Johnson

Mr. Johnson, formerly vice-president, becomes president, and Mr. Wade executive vice-president and general manager. Horace C. Ruggles remains secretary and Harriet Plotkin, treasurer.

Mr. Johnson is a graduate of the School of Mines, University of Minnesota, and spent several years selling heavy machinery in the eastern part of the United States before joining the Penn organization twelve years ago.

Stuart A. Wade, after completing college in 1914, became associated with the Belmont Iron Works of Philadelphia; served with the 7th Regiment in World War 1 and then went into the steel erection business in New York City. He was responsible for much of the steel work in the New York subway system. About 10 years ago he joined the H. O. Penn Machinery Co. and his work as a sales engineer in New York City, Westchester and Rockland Counties soon led to his appointment as second vice-president.

Stuart A. Wade

GEORGE J. DIMOND and John D. Colloton have organized the Dimond-Colloton Equipment Co. with temporary offices at 633 North Water Street, Milwaukee, Wis., to engage in the sale and service of construction and industrial equipment. Already they represent the T. L. Smith Co., of Milwaukee, the Foote Co. of Nunda, N. Y., and the Gorman-Rupp Co. of Mansfield, Ohio.

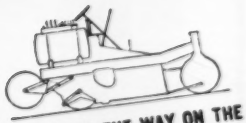
Mr. Dimond joined the Koehring Co. of Milwaukee 27 years ago as a field service representative and rose to sales manager. In 1944 he joined the Insley

Another ADNUN BLACK TOP PAVER First!

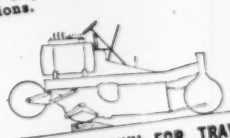
FASTER . . . Easier job-to-job travel . . . with the ADNUN Carryall

ADNUN leads again! Now between-jobs travel is a much simpler, faster operation than ever before with the Adnun Carryall. Two pneumatic, rubber-tired wheels on heavy, retractable frames lift the rear rolls clear of the ground—ready for fast towing or self-propelled travel with the powerful Adnun front-wheel drive. On the job, Adnun Carryall wheels lock up and out of the way of paving operations. Either putting the wheels down for travel or up for work is a quick, easy job. . . . Done on the spot without jacks or other special tools. Where long strips of cold material are being laid, and job conditions prevent paving in both directions, the Adnun Carryall can save hours per job in getting back—fast—to start a new strip.

Adnun Carryalls can be quickly attached to your present Adnun Black Top Pavers, or furnished already installed on new machines. Give serial numbers of your Adnuns when ordering.



UP AND OUT OF THE WAY ON THE JOB
In retracted position, the Adnun Carryall gives plenty of clearance and is well out of the way during black top paving operations.



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Just back the rolls of your Adnun onto a block, drop the Carryall wheels and insert the lock pin. . . . You're ready to travel! And no trailers or ramps are necessary.

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There's nothing complicated about using the Adnun Carryall. . . . Only a few minutes required to put your Adnun on the job, or get it set for fast towing or self-propelled travel.

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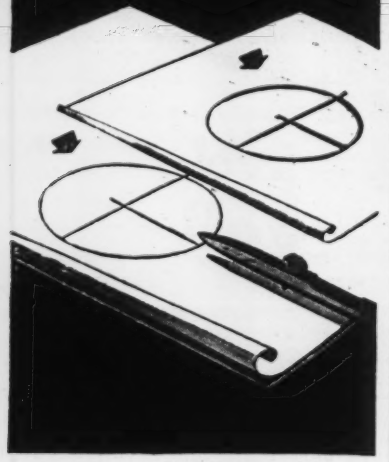

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If you like a duller surface, for clear, hard pencil lines, try Imperial Pencil Tracing Cloth. It is good for ink as well.

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SOLD BY LEADING STATIONERY AND DRAWING MATERIAL DEALERS EVERYWHERE

Manufacturing Corp. of Indianapolis, Ind., as vice-president in charge of sales.

Mr. Colloton attended the University of Wisconsin and spent several years with the Milwaukee County highway department and later was a salesman for the Standard Oil Co. of Indiana. For the last four years he has been a construction equipment distributor in Chicago.

IN A RECENT meeting at Cedar Rapids, Iowa, district sales representatives of LaPlant-Choate Manufacturing Co., Inc., were informed of new sales policies by E. R. Galvin, newly appointed executive vice-president and general sales manager.

It was announced that immediate steps are being taken to establish a completely new world-wide LaPlant-Choate dealer sales and service organization, with a number of new dealers already appointed. All LaPlant-Choate products including hydraulic dozers and land clearing equipment which will continue to be available for use with Caterpillar tractors throughout 1946 and possibly longer, will be sold and serviced exclusively by LaPlant-Choate dealers as rapidly as they are appointed. Representatives witnessed demonstrations of the improved line of 6, 8 and 14-yd. cable scrapers and a preview workout of a new high speed, rubber-tired prime mover and 15-yd. scraper combination. A limited number of these new rubber-tired machines will be produced this year, with full scale production to commence in 1947.

APPOINTMENT of Paul W Zumbrook as manager of domestic lubricating oil sales of Sinclair Refining Co., has been announced. He will coordinate the service and distribution of the Sinclair automotive and industrial lubrication staffs, working with equipment manufacturers for the development of lubricating oils. Mr. Zumbrook became associated with the Sinclair Refining Co. when the Chicago office started in 1916.

GEORGE FOBIAN has been elected president of the Oilgear Co., Milwaukee, Wis., to succeed the late Harry M. Swigart. Fobian started with Oilgear in 1923 as an engineer, later was made sales manager and in 1939 was elected a vice president. He was made a member of the board of directors last year.

APPOINTMENT of Edward W. Gamble, Jr., as sales assistant to the president of Monsanto Chemical Co., has been announced by William M. Rand, president.

E. W. BAUMAN has been appointed executive secretary of the Toncan Culvert Manufacturers Association. Mr. Bauman was highway materials engineer for the association prior to the war, during which he served as chief of the Non-Metallic

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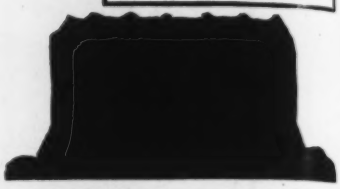

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COVERS the how and why of foundation and substructure design and construction, the general theory of structural members, the detailed design of such members and the design of their connection with other members.

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"Some time ago, we were called in by a prominent manufacturer.* Corrosion of all metal parts in his entire plant had gone out of control. The machine shop and hand tools, valued in excess of $100,000, were a sorry looking "dusty-brown." Everything they had used in the way of rust preventives heretofore failed to solve their difficulty.

After studying their problem we recommended our General Purpose Anti-Corrode No. 100 and suggested that they give it exhaustive tests. Their chemist did so and we are happy to report that it solved their problem.

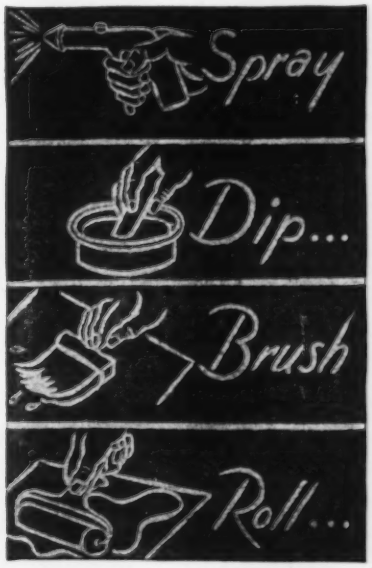
Used On Hand Tools As Well

They have since used over 150 gallons of this Anti-Corrode on everything metal in their plant, including small hand tools such as pliers and screw drivers."

Anti-Corrode No. 100 is one of several new types of Cities Service protective coatings for metals. Designed to prevent corrosion of raw stocks, finished parts and completed machines, it adheres firmly, displaces moisture and protects longer than similar materials now on the market.

Easy To Apply

Apply Anti-Corrode by ordinary work-shop methods. Spray, dip, brush or roll it on. The protective film is continuous and non-porous—does not break at sharp edges nor rupture on flat surfaces. It need not be removed from metal to be stamped, drawn or otherwise formed.



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Section, Mining Division, War Production Board.

F. W. AYERS, until recently on the sales service force of the Bemis Bro. Bag Co., at Peoria, Ill., has been transferred to the Bemis plant at San Francisco, Cal.

MINNEAPOLIS-HONEYWELL REGULATOR Co. has announced the opening of new offices in Denver, Colo., and Salt Lake City Utah, and expansion of existing offices in Washington, D. C., Los Angeles, Calif. and Spokane, Wash.

FREDERICK G. MERCKEL, executive assistant of Wallace & Tiernan Industries, was recently honored on completion of his 25 years of service with the company.

WILLIAM KEARN has joined the sales staff of Keystone Asphalt Products Co. Mr. Kearn is well known in the construction field as an engineer in airport and highway construction. After having been honorably discharged from the Canadian Army, he was a civilian technician for the War Department, working as a construction engineer on the Alcan Highway. Mr. Kearn will be a sales engineer, making the Chicago office his headquarters.

THE NOVO ENGINE CO., Lansing, Mich., has appointed Lee M. Corless chief engineer. In 1930 Mr. Corless was graduated from Michigan State College with a B.S. degree in mechanical engineering. After graduation he joined the engineering staff of the Chevrolet division of General Motors Corp. in Detroit.

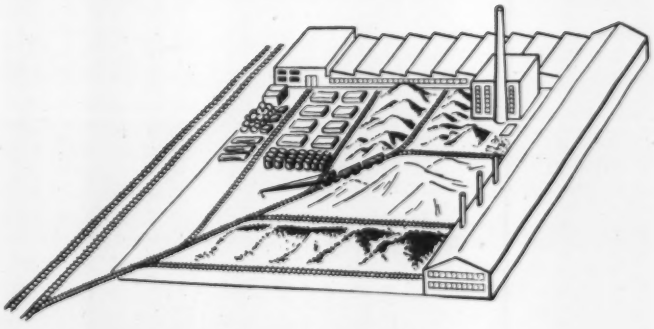
In 1941, he was called to active duty in the Army as a 1st lieutenant with the Quartermaster Corps at Fort Francis E. Warren. He was in the motor transport and maintenance section and advanced to lieutenant colonel, and became chief of the motor training branch. He went to Camp Maxey, Tex., to activate the 163rd Q.M. Bn., Mobile.

THE NEW YORK OFFICE of the Clay Sewer Pipe Association has been moved from 516 Fifth Avenue to 26 Court Street, Brooklyn 2, N. Y. Larger quarters were required by the appointment of H. G. Carlson to the association's field engineering staff. Mr. Carlson, district engineer, will have his headquarters with Benjamin Eisner, chief engineer of the association at the new address. Prior to appointment with the association, Mr. Carlson served with the United States Merchant Marine and is a civil engineering graduate of the University of Michigan.

JAMES M. SOMMER has been appointed manager of the Central Illinois Branch for the Hugh J. Baker & Co. His headquirters will be at Decatur, Ill.

New Salesman for Rail Service

The new "American" Diesel-Electric Locomotive Crane makes rail-served storage yards and stock piles more economical and convenient than ever before. This efficient all-purpose equipment makes it still more desirable for industrial concerns, large and small, to use the railroads, both for shipping in and shipping out. It is the perfect answer to the private switching problem — powerful, easily controlled, smooth starting, fast moving, sharp turning. It is a most flexible and durable materials-handler — easily changed from hook to bucket to magnet, and supplying current for the magnet. It piles high and wide and works safely inside buildings and out — is smoke and spark-free. Study all *your* storage requirements in the light of this new "streamliner of the storage yards." Individually designed diesel, gasoline and steam models are also available.



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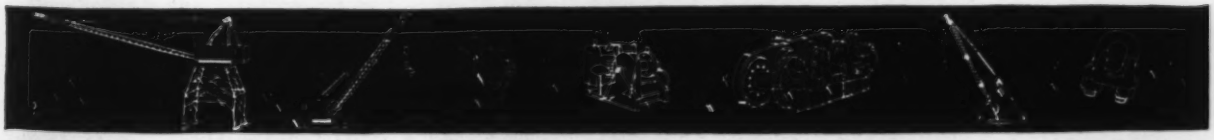


REVOLVERS LOCOMOTIVE CRANES HOISTS DERRICKS BLOCKS AND SHEAVES CROSBY CLIPS

5 DIFFICULT JOBS
on a 1500-mile overland trip

and this MORRIS Hydraulic-Cutter DREDGE will shortly move again . . .

Transported overland a total of more than 1500 miles—from Chicago to Roslyn Lake at the foot of Mt. Hood, Oregon—this Morris Dredge has demonstrated over and over again its mobility, maneuverability, and ability to handle a wide range of difficult deposits through long discharge lines and against high heads. It has:

1. Been assembled, dismantled and moved overland four different times; part of the way by trucks.
2. Worked on five difficult deposits.
3. Been quickly and easily reassembled merely by bolting up the compact four-section hull, and the light weight deck house panel sections.

An electrically operated, hydraulic-cutter dredge with a Morris 12" Heavy Duty Dredge Pump, the Captain George is a type of Morris dredge that will handle the most stubborn deposits. Designed for mobility, flexibility and ease of maneuvering, it is especially suited to reservoir cleaning, filling low lands, draining low areas, park beautification and general municipal projects.

Write for
SPECIAL BULLETIN 177
containing descriptions, specifications, and recommendations on Morris hydraulic dredging plants.

THE LOG OF THE CAPTAIN GEORGE

Built in 1930 for heavy sand and gravel production at Chicago, where it delivered through 1500' of 12" pipe against a 30' static head.

Dismantled, moved overland and assembled at Alton, Illinois, for general dredging work on the Mississippi.

Towed upstream for construction work on a Mississippi dam at Dubuque, Ia.

Dismantled, moved overland and assembled at Albert Lea, Minnesota, where it pumped more than 1,000,000 cu. yds. of mud, clay, sand and gravel through discharge lines up to 3500' in length.

Dismantled and moved by train to Portland, Oregon.

Cut apart and moved by trucks from Portland to Roslyn Lake in the Cascade Mountains.

Will shortly be dismantled for another move by truck to a forebay lake on the Clackamas River.

MORRIS MACHINE WORKS Baldwinsville, N. Y.
Sales Offices in Principal Cities

MORRIS CENTRIFUGAL PUMPS

ROBINS CONVEYORS, INC., of Passaic, N. J., a division of Hewitt Rubber Corp., has announced that R. W. Eichenberger, vice-president, has moved to the Chicago office to supervise sales in the Western division. He succeeds J. F. Meissner, resigned. Mr. Eichenberger joined Robins in 1910 and has served in sales and engineering work. Recently in charge of engineering, he was located at the company's Passaic, N. J., manufacturing headquarters. In the Chicago office, Mr. Eichenberger will be assisted by E. P. Larsen, who has been a Robins sales engineer in the Western division for several years.

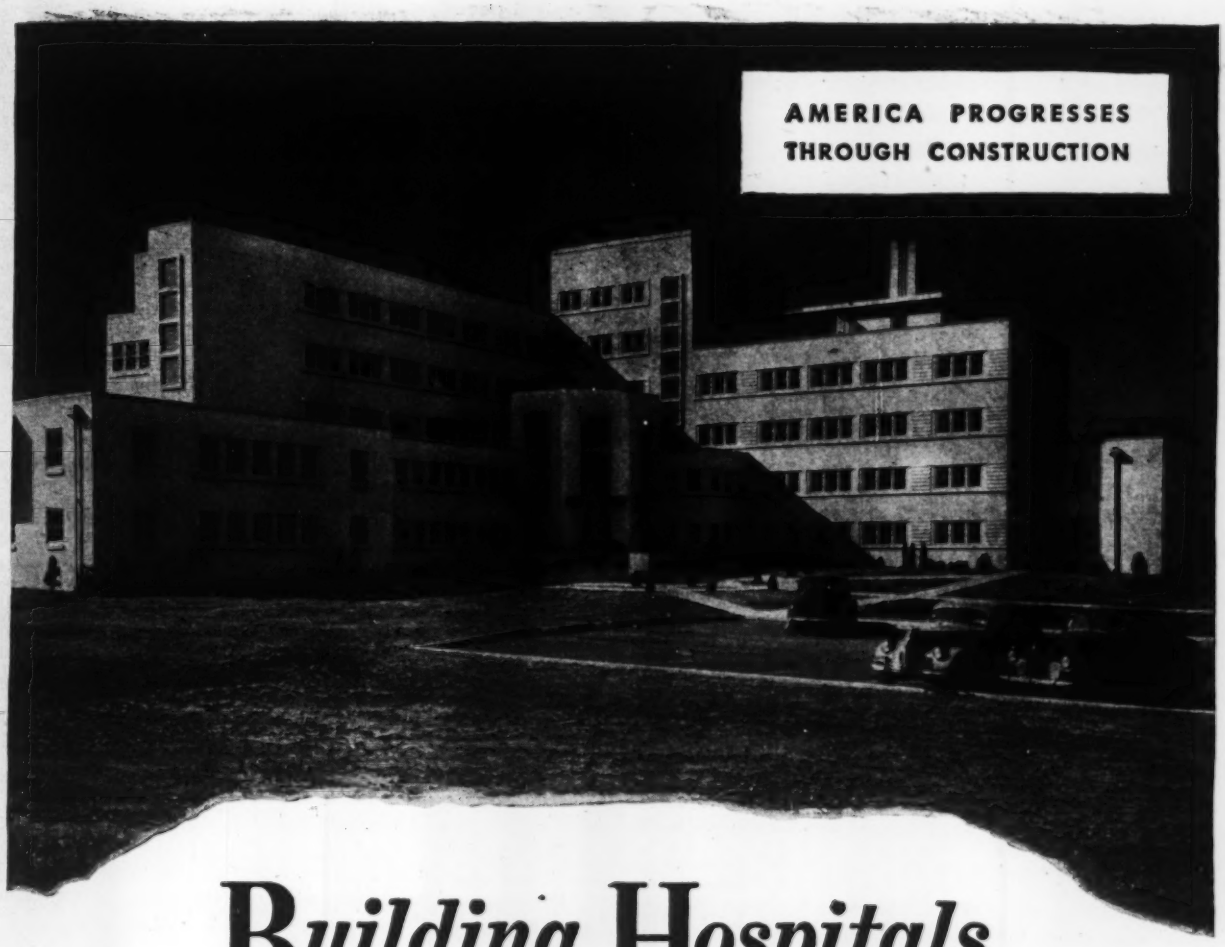
CORNELL E. JONES, formerly a major in the Army Corps of Engineers, has been named sales development manager of the Caterpillar Tractor Co., Peoria, Ill. Mr. Jones has served with county and state highway departments, the J. D. Adams Co., and International Harvester Co. in domestic and foreign operations. During the war, he was assigned to the Peoria, Ill., industrial area, charged with procuring Caterpillar products for the Corps of Engineers. He takes over the duties of Kenneth F. Park, recently named to the newly-created post of engineering consultant in the earthmoving field.

THE DELAVAL STEAM TURBINE CO., Trenton, N. J., has announced the appointment of H. H. Barrows and his organization—the Industrial Equipment Co.—as sales representatives throughout the lower Michigan peninsula for the IMO Pump and Worm Gear Division.

E. A. DANIELS and E. O. Williams have been elected recently to the post of vice presidents of Victor Equipment Co., San Francisco, Calif. Mr. Daniels was formerly sales manager and Mr. Williams was formerly district manager with offices in Los Angeles.

IRON & STEEL PRODUCTS, INC., has announced the appointment of Charles A. Marshall as sales engineer with headquarters in Chicago, Ill.

Mr. Marshall is an ex-railroader, formerly connected with the Baltimore & Ohio, Wabash, and the Central Railroad of New Jersey. In recent years he served as a manufacturers' representative specializing in materials-handling equipment in the southern West Virginia territory.



Building Hospitals

BUILDS WEALTH THROUGH HEALTH

THIS country needs from 1500 to 2000 new civilian hospitals and 2700 health centers, the U. S. Public Health Service reports. This need is emphasized because approximately 1200 counties, with a population of about 15,000,000 have no hospitals within their boundaries. The cost of supplying these National health needs would amount to more than $2,000,000,000.

In addition, the Veterans' Administration program calls for the construction of 77 new hospitals. The cost of these hospitals, together with additions and improvements to the 106 existing veterans' institutions, will be $448,000,000.

These civilian and veteran hospital facilities deserve the best in planning and execution. A. G. C. contractors have the skill, integrity and responsibility to construct these health projects of highest quality with maximum efficiency and economy. They are pledged to sound business principles exemplified by the A.G.C. emblem.

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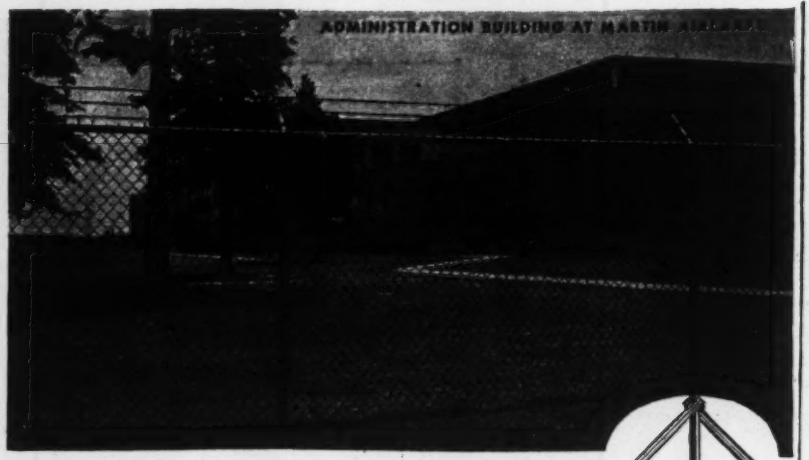

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Says The Glenn L. Martin Company: "We have standardized on Anchor Chain Link Fence for many years . . . first at Cleveland, and here in Baltimore since 1929. Nearly 10 miles of Anchor Fence now protect our plants, grounds and airport here at Baltimore. Despite our waterfront location, maintenance costs have proved negligible, and even Anchor Fences erected here in 1929 are still in excellent condition."

The pictures on this page show you some exclusive Anchor features, which help explain why Martin Aircraft and many other prominent companies specify Anchor Fence.

Send for this Book! Write today for our big Industrial Fence Catalog . . . packed with information, diagrams and ideas . . . and with photographs of Anchor Fence installations for many well known industrial users. Or let us have one of our experienced engineers call and give you the benefit of his knowledge in solving plant protection problems. Address: Anchor Post Fence Co., 6665 Eastern Avenue, Baltimore 24, Maryland.

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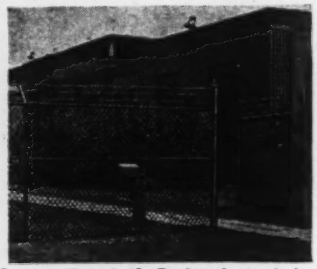
Exclusive with Anchor, deep-driven "Anchors" clamped to the posts form a 3-point anchorage deep in the subsoil; hold posts permanently erect and in line in any soil or climate.



Square Terminal Posts, also exclusive with Anchor, improve appearance and are stronger than round posts of comparable size. Cross bracing to adjoining line posts increases rigidity.

The Barbed Selvage of Anchor Chain Link fabric and three strands of barbed wire stand ready to repel any attempt at climbing—protecting aircraft stored outdoors.

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Continental offers a complete line of concrete pipe manufacturing equipment—
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Machine made pipe molds for any description, T & G, or B.E., for plain or reinforced pipe;
Cast pipe equipment up to 136" diam. in any length.
Let us design your concrete pipe plant—either machine pipe plant or cast pipe plant.

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TYPE E ENCLOSED IMPELLED

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Sizes 1" to 12"

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Manufacturers' Publications

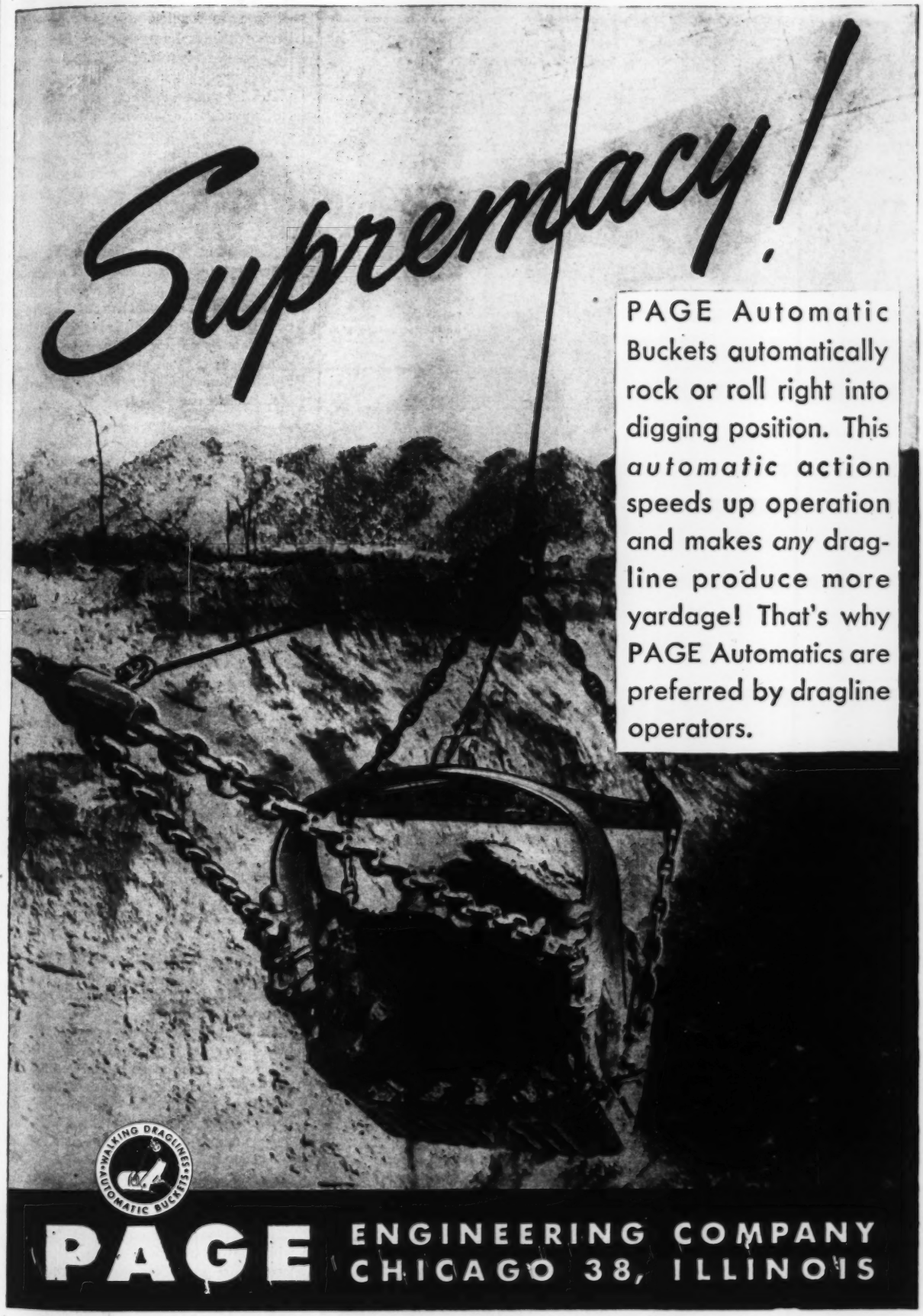
Welding Rods—A 16-page, 2-color booklet describes the physical and chemical properties of phosphor bronze electric welding rods. It gives uses and techniques for welding copper, bronze, cast iron, steel and their alloys; and contains a polarity table and directions for best welding results.—*Eccles & Davies Machinery Co., Inc., Los Angeles, Calif.*

Airport Design—A handsome brochure presents the case for central heating at an airport center and demonstrates how the application of this principle can affect the entire conception of airport design. It is claimed that an airport center strategically located on super highways and central to a number of municipalities could support retail establishments, amusement places, hotels, residences, manufacturing and warehousing activities. Information consisting of illustrations, blue prints, cost data, etc., is presented to show that such a project is economically feasible.—*RiwiL Co., Union Commerce Building, Cleveland, Ohio.*

Protective Coating—An illustrated booklet tells of a product that is said to offer positive protection against acids, alkalies, oil and water—one material for all purposes, painted on concrete or metal surfaces by brush, spray gun or dipping. It can be applied by a plant's own maintenance crew.—*Prufcoat Laboratories, Inc., 63 Main St., Cambridge 42, Mass.*

Portable Conveyors—A 24-page catalog lists, illustrates and describes a line of portable conveyors which includes conveyors for building materials and placing concrete. A troughing type conveyor is most desirable for handling loose materials such as ashes, cement cinders, clay, crushed stone, earth, gravel lime, sand and wet concrete. The catalog also tells about snow loaders, bucket loaders, sheave buckets and clamshell buckets.—*George Haiss Mfgrs. Co. Inc., 141st St. to 144th St. on Canal Place, Park and Rider Aves, New York 51, N. Y.*

Straight-type Bulldozers—A broadside describes and liberally illustrates new bulldozers, designed and built for exclusive use with "Caterpillar" diesel D8 and D7 tractors. The publication features the attributes of the equipment: balanced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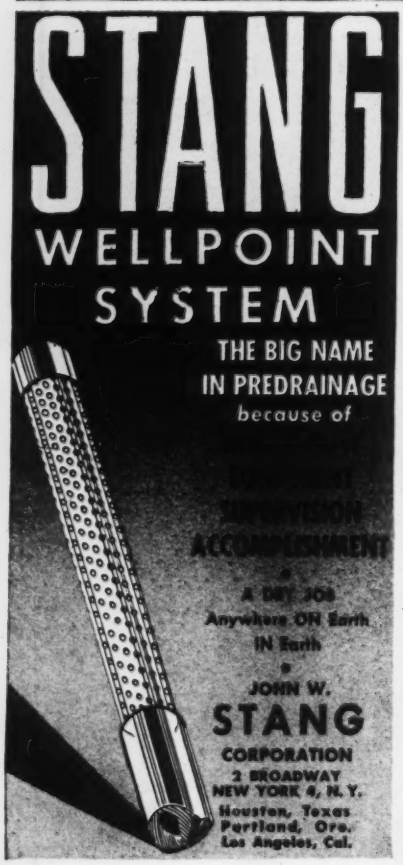

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design; unexcelled digging characteristics with excellent visibility for operator; ease of mounting and dismounting; correctly curvey moldboard; reinforcing plates for pusher loading and to back up cutting edge; easily made blade pitch and tilting adjustments; blade follow through; rigidity; long life and sheave support arrangement eliminating the A-frame structure.—*Caterpillar Tractor Co, Peoria 8, Ill.*

Unloading Hopper-bottom Cars—A patent-pending car shakeout is described in a circular. In as little as 90 seconds, hopper-bottom railroad cars can be emptied completely of free-flowing bulk materials by as few as two men, without damage to cars or danger to workmen. Seismic action does it.—*Robins Conveyors, Inc., Passaic, N. J.*

Self-cleaning Water Strainer—A circular gives a description of the equipment, the capacities, the straining media, and other engineering data covering the latest design, which removes fine suspended particles from raw or process water, and disposes of the particles in a continuous, automatic and self-cleaning manner, assuring a steady flow of clean water from rivers, lakes or wells.—*S. P. Kinney Engineers, Inc., 233 Oliver Ave., Pittsburgh 22, Pa.*

Portable Gasoline-driven Generators—A bulletin pictorially describes new model generators in which aluminum alloys in all major castings plus 2-cycle engine design make possible high horsepower to weight ratio. On-the-job photographs illustrate the advantages of a portable power plant always ready to furnish power under all conditions and at any location. Power for floodlighting emergencies or night work and to operate electric drills and saws, the time-savers of construction.—*Homelite Corp., Port Chester, N. Y.*

Testing of Materials—Described in a brochure is this concern's testing of materials, which includes research into the nature of substances as well as routine physical and chemical analyses of all kinds. Another function described is field inspection and testing, including the checking of quality, quantity, and specifications of materials. This service also includes the inspection of buildings, engineering projects, and materials during construction.—*Pittsburgh Testing Laboratories, Pittsburgh, Pa.*

How to Cut Cast Iron—An illustrated circular covers the cutting of cast iron with the oxy-acetylene flame. For many years cast iron cutting was considered almost impossible, but it is said that now with proper apparatus and technique the

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on a Nation-wide scale

OTIS MAINTENANCE FOR OTIS ELEVATORS

The men and women in your local Otis office — friends and neighbors of your townspeople — are working to maintain service on Otis elevators in your locality — at standards based on nation-wide experience.

Your office and the 244 other Otis offices report regularly to headquarters on every elevator under Otis Maintenance Service, and standards for your locality are based on analyses of these nation-wide reports. If yours is a small freight elevator, it must compare favorably with 5,700 others in its class. If you have a high-speed gearless passenger installation, it is graded against more than 3,000 others in the same group.

Otis Maintenance is a service by Otis for Otis elevator owners . . . available at a flat monthly rate through your local Otis office.

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES

2/10ths of a cent per ton for jaw plates in a *KUE-KEN balanced crusher

The KUE-KEN principle of crushing without abrasion gives this operator a cost of only 2/10ths of a cent per ton for jaw plate replacement. Crushing medium hard run-of-mine quartz to ¾" (41% minus ¼"), he gets 81,243 tons per set of jaw plates. With practically the same horsepower, this KUE-KEN crushes 27½ tons per hour compared to 4 tons per hour obtained with the previous ordinary crusher. Almost 7 times more capacity per horsepower.

Other KUE-KEN users are making similar savings. A KUE-KEN crusher will make more profit for you. They are available from 5 to 50 tons per hour capacity. Reasonable delivery can be made at the present time.

* Pronounced Q-KEN

Send for catalog 602 today.

S. TRAUB MFG. CO.

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Kue-Ken Balanced Crushers • Ribcone Ball Mills • Screenwheel Classifiers • Overhead Eccentric Crushers • Feeders • Gyracones • Concentrating Tables • Spiral Classifiers.

job can be done successfully and economically. The circular discusses proper types of equipment, preheating conditions, cutting positions, need of adequate protective clothing, proper oxygen and acetylene pressures, etc.—*National Cylinder Gas Co., 205 W. Wacker Drive, Chicago 6, Ill.*

Ventilating and Heating System—Those who specify, design, purchase or install ventilating or heating systems will find interesting data in a new book issued by this manufacturer to describe its plant.—*Ilg Electric Ventilating Co., Chicago, Ill.*

How Caterpillars Are Made—A thoroughly illustrated 16-page booklet describes the manufacturing processes which turn out this company's well-known line of construction machinery. Pictured are the skilled workmen using the modern machine tools in the precision methods which mark the company's production. The illustrations include pictures of the finished products in their various fields of operation, where the values of manufacturing methods are tested under the stress of the job.—*Caterpillar Tractor Co., Peoria 8, Ill.*

Pitot Equipment—A bulletin gives complete details of the use of pitot tubes and rods, instructions in the use of a portable pitot recorder, together with the theory, formulae, notations, tables and curves of use with pitot tubes, manometers and recorders.—*Simplex Valve & Meter Co., 6751 Upland Street, Philadelphia 42, Pa.*

Earth Movers—Two new catalog folders feature a 15-ton, rear-dump model for off-the-highway hauling of earth, rock, ore and heavy excavation with a struck measure capacity of 9.7 cu. yds. and a top loaded speed of 22 m.p.h.; and a 13 cu. yd. bottom-dump model designed for big jobs, and with a payload capacity of 40,000 lbs., and a maximum speed loaded of 26 m.p.h.—*The Euclid Road Machinery Co., Cleveland 17, Ohio.*

Hard Surfacing—A technical bulletin covers hard surfacing and the use of electrodes in building up surfaces for resistance to shock and abrasion. The bulletin contains sixteen pages concerning such factors as effect of temperature and cooling rates on deposited metal, selection of the proper grade of rod, and recommended welding techniques. This method can be used for concrete mixer blades, crusher rolls, dipper fronts and lips, dragline bucket pins and links, gravel washer outlet pipes, gyratory crusher mantles, sheepsfoot tampers and shovel boom sockets, carrier rollers, crawler pads, driving tumblers and idler wheels.—*Metal & Thermit Corp., 120 Broadway, New York 5, N. Y.*

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